SECTION 00 01 01 PROJECT TITLE PAGE

Project Specifications for: Northport FMS #9 Renovations

Owner: Armory Commission of Alabama 1720 Congressman WL Dickinson Drive Montgomery, AL 36109 Architect: Seay Seay & Litchfield, P.C. 1115 South Court Street Montgomery, AL 36104

IFB #: AC-22-B-0004-S

Date: January 2022

Set Number _____

Prepared _____

Checked _____

Approved _____

Northport FMS#9 Renovations Northport, AL

SECTION 00 01 03 - PROJECT DIRECTORY

(Revised 22 June 2021)

PART 1 GENERAL

- 1.01 SECTION INCLUDES
 - A. Identification of project team members and their contact information.
- 1.02 OWNER:
 - A. Name: Armory Commission of Alabama
 - 1. Address: 1720 Cong. W.L. Dickinson Drive
 - 2. City: Montgomery
 - 3. State: AL
 - 4. Zip Code: 36109
- 1.03 ARCHITECT/ENGINEER OF RECORD:
 - A. Architect:
 - 1. Company Name: Seay Seay & Litchfield, P.C.
 - a. Address: 1115 South Court Street
 - b. City: Montgomery
 - c. State: Alabama
 - d. Zip Code: 36104
 - e. Telephone: 334-263-5162
 - 2. Primary Contact: .
 - a. Title: Firm Director
 - b. Name: Casey Ivy
 - c. Telephone: 334-263-5162
 - d. Email: civy@sslarch.com

1.04 CONSULTANTS TO THE ARCHITECT/ENGINEER OF RECORD:

- B. Civil Engineering Consultant:
 - 1. Company Name: Professional Engineering Consultants
 - a. Address: 822 S. McDonough St.
 - b. City: Montgomery
 - c. State: Alabama
 - d. Zip Code: 36104
 - C. Structural Engineering Consultant:
 - 1. Company Name: Blackburn Daniels O'barr Inc.
 - a. Address: 8850 Co Rd 40
 - b. City: Lowndesboro
 - c. State: Alabama
 - d. Zip Code: 36752
- D. Mechanical Engineering Consultant Plumbing & Mechanical:
 - Company Name: Whorton Engineering
 - a. Address: 25 Summerall Gate Rd
 - b. City: Anniston
 - c. State: Alabama
 - d. Zip Code: 36205
- E. Electrical Engineering Consultant:
 - 1. Company Name: Gunn & Associates, P.E.
 - a. Address: 3102 Highway 14
 - b. City: Millbrook
 - c. State: Alabama
 - d. Zip Code: 36054

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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Northport FMS#9 Renovations Northport, AL

SECTION 00 01 07 - PROFESSIONAL SEALS

PROFESSIONAL SEALS OF DESIGN PROFESSIONALS:

1.01 THE SPACE ALLOTTED BELOW IS FOR PROFESSIONAL SEALS OF DESIGN PROFESSIONALS RESPONSIBLE FOR PREPARING THE CONSTRUCTION DOCUMENTS.

ARCHITECTURAL



CIVIL







ELECTRICAL



(Revised: 17 August 2021)

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- S1.1 FOUNDATION PLAN EXISTING MAINTENANCE SHOP
- \$1.2 FOUNDATION PLAN STORAGE BUILDING
- \$1.3 ROOF FRAMING PLAN STORAGE BUILDING
- S1.4 ROOF FRAMING PLAN NEW WASH RACK
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- A1.1 EXISTING FLOOR PLAN DEMOLITION
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- A3.18 FINISH AND DOOR SCHEDULE STORAGE BUILDING
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- M1.3 HVAC SCHEDULES AND DETAILS
- M1.4 HVAC SCHEDULES AND DETAILS
- M2.1 HVAC DETAILS
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- E5.1 LUMINAIRE SCHEDULE
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- E6.1 RISER DIAGRAM POWER DISTRIBUTION
- E6.2 GROUNDING DETAILS

Northport FMS#9 Renovations Northport, AL SECTION 00 21 00 - INSTRUCTIONS TO BIDDERS

1. INTENT OF INSTRUCTION:

Instructions to Bidders are included in the Contract Documents to amplify the invitation for Bids, which is abbreviated because of cost and space limitations, and to five other details which interested parties must or should know in order to prepare bids properly.

2. PREQUALIFICATION OF BIDDERS:

Bidders for work costing in excess of \$50,000.00 must be licensed under the terms of existing State laws. In case of a joint venture of two or more contractors, the amount of the bid shall be within the maximum bid limitation as set by the State Licensing Board for General Contractors of the combined limitations of the partners to the joint venture. Before award of any Contract, any Bidder may be required to file under oath with the Commission a complete Confidential Financial Statement, Equipment Questionnaire, and Experience Questionnaire on forms that will be furnished by the Contracting Officer with the request. If the applicant is a corporation organized in a state other than Alabama, it shall furnish a certificate from the Secretary of State showing that it is qualified to transact business in Alabama.

Copies of the Contract Documents may be obtained from the Contracting Officer, as stated in the Invitation For Bids.

3. EXAMINATION OF CONTRACT DOCUMENTS AND OF THE SITE OF THE WORK:

Before submitting a proposal for the work, the bidders shall carefully examine the Contract Documents, visit the site, and satisfy themselves as to the nature and location of the Work, and the general and local conditions, including weather, the general character of the site or building, the character and extent of existing work within or adjacent to the site, and any other work being performed thereon at the time of submission of their bids. They shall obtain full knowledge as to transportation, disposal, handling, and storage of materials, availability of water, electric power, and all other facilities in the area which will have a bearing on the performance of the Work for which they submit their proposals. The submission of a proposal shall be prima facie evidence that the bidder has made such examination and visit and has judged for and satisfied himself as to conditions to be encountered regarding the character, difficulties, quality and quantities of work to be performed and the material and equipment to be furnished, and as to the contract requirements and contingencies involved.

If, in the performance of the Contract, subsurface or latent conditions are found to be materially different from those indicated by the Drawings and Specifications, or unknown conditions of an unusual or impractical nature are disclosed differing materially from conditions usually inherent in work of the character shown and specified, the attention of the Engineer shall be called immediately to such conditions before they are disturbed. Upon such notice, or upon observation of conditions, the Engineer will promptly make such changes in the Drawings and/or Specifications as he finds necessary to conform to the different conditions, and any increase or decrease in the cost of the Work resulting from such changes will be adjusted as provided under CHANGES IN THE WORK or EXTRA WORK as set forth in the GENERAL CONDITIONS.

4. EXPLANATIONS AND INTERPRETATIONS:

Should any bidder observe any ambiguity, discrepancy, omission, or error in the Drawings and Specifications, or in any other Contract Document, or be in doubt as to the intention and meaning thereof, he should at once report such to the Engineer and request clarification, in writing, with a copy of his request to the Contracting Officer. Clarification will be made only by written addenda sent to all prospective bidders. Neither the Engineer, nor the Contracting Officer will be responsible in any manner for verbal answers regarding intent or meaning of the Contract Documents, or for any verbal instructions, by whomsoever made, prior to the award of the Contract.

Should conflict occur in or between Drawings and Specifications, a bidder will be deemed to have estimated on the more expensive way of doing the work involved unless he shall have asked for and obtained the written decision of the Engineer before submission of his bid as to method, materials, or equipment which will be required.

5. CONTENTS OF PROPOSAL FORMS:

The Contracting Officer as stated in the advertisement, will furnish bidders blank bid forms for the work contemplated, indicating the lump sum bid items, alternate bid items, and unit price bid items.

6. LIQUIDATED DAMAGES:

Time is the essence of the Contract and the bidder's attention is called to that clause of the GENERAL CONDITIONS which requires the deduction of a stipulated time charge equal to six percent interest per annum on the total Contract Price for the work for the entire period that any part of the work remains uncompleted after the time specified in the Contract documents for completion of the work which will be deducted by the Contracting Officer from the final estimate and retained by the Owner out of the moneys otherwise due the Contractor in the final payment, not as a penalty but as liquidated damages sustained by the Owner.

7. PREPARATION OF BID:

The bid must be submitted on the bid form furnished by the Owner or Contracting Officer as stated in the Invitation for Bids.

The bid shall be properly signed by the bidder. If the bidder is an individual, his name and post office address must be shown; if a firm or partnership, the name and post office address of each member of the firm or partnership must be shown; if a corporation, the President, Vice-President, or Secretary shall sign and affix the corporate seal, or if the person signing the bid is an agent, the said agent must attach written authorization from the President, Vice-President or Secretary of the corporation, and the bid must show the name of the corporation, the name of the state under the laws of which the corporation is chartered and the names, titles, and business address of the officers.

8. BID GUARANTY:

No bid submitted will be considered unless accompanied by a certified check or bid bond made payable to the Owner in an amount not less than five percent (5%) of the Contractor's bid, but in no event more than ten thousand dollars (\$10,000.00), as a guaranty that the bidder will enter into a contract with the Owner for the Performance of the work and furnish contract bonds for the work if it be awarded to him.

9. DELIVERY OF BIDS:

Each Bid shall be placed, together with Bid Guaranty, in a sealed envelope on the outside of which is written in large letters "Bid" and so marked as to identify the Work bid on and the name of the Bidder. Bid may be delivered in person, or by mail if ample time is allowed for delivery. When sent by mail, preferable special delivery or registered, the sealed Bid marked as indicated above, shall be enclosed in another envelope for mailing. Bid will be received at the place stated and until the hour of the date set in Invitation for Bids for their opening unless notice is given of postponement. No Bid will be accepted or considered which has not been received prior to the hour of the opening date.

10. WITHDRAWAL OR REVISION OF BIDS:

A Bid may be withdrawn at any time prior to the hour fixed for opening of Bids, provided a request in writing executed by the Bidder or his duly authorized representative is filed with the Contracting Officer prior to that time, in which case such Bid, when received will be returned to the Bidder unopened. Telegrams or written communications to correct Bid will be accepted and the Bid corrected in accordance therewith if received by the Contracting Officer prior to the hour set in the Invitation for Bids. No Bid shall be withdrawn, modified, or corrected after the hour set for opening such Bid.

11. OPENING OF BIDS:

Bids will be opened and read publicly at the time and place indicated in the Invitation for Bids. Bidders or their authorized agents are invited to be present.

Northport FMS#9 Renovations Northport, AL 12. IRREGULAR BID:

Bids may be rejected if they contain any omissions, alterations of forms, additions not called for, conditional bids, alternate bids unless called for, incomplete bids, erasures, or irregularities of any kind. Bids in which the unit or lump sum prices bid are obviously unbalanced may be rejected.

13. ERRORS IN BID:

In case or error in the extension of prices, the unit price will govern. In case of discrepancy between the prices shown in the figures and in words, the words will govern.

14. DISQUALIFICATION OF BIDDERS:

Any Bidder using the same or different names for submitting more than one Bid upon any unit, portion, part or section of work will be disqualified from further consideration on that part of the Work. Evidence that any bidder is interested, as a principal, in more than one Bid for the Work (for example, bidding in a partnership; as a joint partnership or association and as a Partnership, association, or individual) will cause the rejection of any such Bid. A Bidder may, however, submit a Bid as a principal and as a subcontractor to some other principal, or may submit a Bid as a subcontractor to as many other principals as he desires, and by so doing will not be liable to disqualification.

If there is reason for believing that collusion exists among the bidders any or all Bids may be rejected, and participants in such collusion may not be considered in future Bids for the same work. Bids in which prices are obviously unbalanced or unresponsive to the Invitation for Bids may be rejected.

The right is reserved to reject a Bid from Bidder who has not paid, or satisfactorily settled, all bills due for labor and material on former contracts in force at the time of letting.

15. CONSIDERATION OF BIDS:

After the Bids are opened and read, the Bid prices will be compared and the results of such comparison will be made public. Until the final award of the Contract, however, the Owner reserves the right to reject any all Bids, and to accept or reject any or all items of any bid and to waive technical errors and any informality if, in his judgement, the best interests of the Owner will thereby be promoted.

16. DETERMINATION OF LOW BIDDER:

The low bidder will be determined by the total Bid of all Items on the bid form that are accepted.

17. AWARD OF CONTRACT:

The Contract will be awarded to the lowest responsible bidder complying with all established requirements of the Contract Documents unless the Owner finds that his bid is unreasonable or that it is not in the interest of the Owner to accept it, and subject to the Owner" right to award on the basis of any bid item or any combination of bid items. A bidder to whom award is made will be notified at the earliest possible date.

18. RETURN OF BID GUARANTIES:

All Bid Guaranties, except those of the three lowest bona fide bidders, will be returned immediately after Bids have been checked, tabulated, and the relation of the Bid established. The Bid Guaranty of the three lowest bidders will be returned as soon as the Contract Bonds and the Contract of the successful Bidder have been properly executed and approved. Should no award be made within thirty days, all Bids will be rejected, and all guaranties returned, unless the successful Bidder agrees

in writing to a stipulated extension in time for consideration of his bid, in which case the Owner may, at his discretion, permit the successful Bidder to substitute a satisfactory bidder's bond for the certified check submitted with his Bid as a Bid Guaranty.

19. EXECUTION OF CONTRACT:

The Contract shall be signed by the successful Bidder, in the number of counterparts provided in the Contract Agreement, and returned to the Contracting Officer with satisfactory Contract Bonds.

Northport FMS#9 SS&L Renovations Northport, AL 20. REQUIREMENTS OF CONTRACT BONDS:

In order to insure the faithful performance of each and every condition, stipulation, and requirement of the Contract and to indemnify and save harmless the Owner from any and all damages, either directly or indirectly (arising out of any failure to perform same), the successful Bidder to whom the Contract is awarded shall furnish at his expense and file with the Contracting Officer an acceptable Surety Bond in the amount equal to one hundred (100) per cent of the Contract Price of the Contract as awarded. Said Bond shall be made on the approved Bond form, shall be furnished by a surety company duly authorized and qualified to make such bonds in the State of Alabama, shall be countersigned by an authorized agent resident in the State who is qualified for the execution of such instruments, and shall have attached thereto power of attorney of the signing official. In case of default on the part of the Contractor, all expenses incident to ascertaining and collecting losses suffered by the State under the Bond, the direct costs of administration, architectural, engineering, and legal services, shall lie against the Contract Bond for Performance of the Work.

In addition thereto, the successful Bidder to whom the Contract is awarded shall furnish at his expense and file with the Contracting Officer another Bond with good and sufficient surety payable to the Owner in an amount equal to fifty (50) per cent of the Contract Price, with the obligation that the Contractor shall promptly make payment to all persons furnishing him or them with labor, materials, equipment, or supplies for or in prosecution of the Work provided for in the Contract and for the payment of reasonable attorneys fees incurred by successful claimants or plaintiffs in suits on said Bond.

21. APPROVAL OF CONTRACT:

No Contract is binding upon the Owner until it has been executed by the Contracting Officer and approved by the Chief National Guard Bureau, and/or the State Building Commission as required by Federal and State laws and regulations.

22. FAILURE TO EXECUTE CONTRACT:

Should the successful Bidder or Bidders to whom a Contract is awarded fail to execute a Contract and furnish acceptable Contract Bonds within ten days following the date of Award, the Owner shall retain form the Proposal Guaranty if it be a certified check or recover from the Principal of the Sureties if the guaranty be a bond the difference between the amount of the Contract as awarded and the amount of the proposal of the next lowest bidder. If no other bids are received, the full amount of the Proposal Guaranty shall be so retained or recovered as liquidated damages for such default. Any sums so retained or recovered shall be the property of the Owner. In the event of the death of the low bidder (if an individual and not a partnership or corporation) between the date of the opening of bids and the ten days following the date of award of Contract allowed for furnishing the Contract Bonds, the Owner shall return the Proposal Guaranty intact to the estate of the deceased low bidder.

Failure by the Owner to complete the execution of a Contract and to issue a Notice to Proceed within thirty (30) days after its Presentation by the Contractor shall be just cause, unless both parties agree in writing to a stipulated extension in time for issuance of a Notice to Proceed, for withdrawal of the Contractor's bid and Contract Agreement without forfeiture of a certified check or bond.

SECTION 00 41 00 - PROPOSAL FORM (Revision Date: 23 June 2021)

IFB # AC-22-B-0004-S BID OPENING DATE: February 3, 2022 BIDDER

CONTRACTOR'S LICENSE NO.

- TO: The Armory Commission of Alabama State Military Property and Disbursing Officer Headquarters, Alabama National Guard 1720 Cong. W.L. Dickinson Drive Montgomery, Alabama 36109-0711
- PROJECT: Northport FMS #9 Renovations Northport, Alabama

In compliance with your Invitation for Bid, the undersigned hereby proposes to furnish the plant, labor, materials, and equipment and perform all work for the above described project in strict accordance with the specifications, drawings, and addenda number for consideration of the following prices (bid prices do NOT include Sales or Use Taxes in accordance with Act 2013-205):

BID

PERFORM ALL WORK IN ACCORDANCE WITH THE DRAWINGS & SPECIFICATIONS FOR: Brundidge Restoration, Brundidge, Alabama

BID ITEM A (No	rthport FMS #9	Renovation)
----------------	----------------	---------------------

A.B.I. #A-1 (Wash Rack Cover)

ACCOUNTING OF SALES TAX

Pursuant to Act 2013-205, section 1(g) the Contractor accounts for sales tax NOT in the bid form as follows:

BID ITEM A (Northport FMS #9 Renovations)	\$
A.B.I. #A-1 (Wash Rack Cover)	\$

Failure to provide an accounting of sales tax shall render the bid non-responsive. Other than determining responsiveness, sales tax accounting shall not affect the bid pricing nor be considered in the determination of the lowest responsible and responsive bidder.

TIME LIMIT: These bids are subject to an acceptance period of thirty (30) days.

All amounts and totals given will be subject to verification by the State. In case of variation between A. unit bid price and total shown by bidder, the unit price will be considered to be his bid. The State reserves the right to award the work on the basis of any bid or any combination of bids and to increase or decrease the quantities of any item listed in this bid at the price quoted for that particular item.

Β. Bids shall be for the entire work and shall have each blank space filled in to include the "Estimated Sales Tax Accounting".

The quantities of each item of the bid as finally ascertained at the close of the contract will determine C. the total payment to accrue under the contract.

ESTIMATED SALES TAX AMOUNT

D. The bidder, upon request of written notice of award of the contract within thirty (30) days after the date of opening of bids, agrees that he will execute the construction contract in accordance with this bid as accepted, and if the consideration of the contract will exceed \$50,000.00 in amount, will furnish to the State a Performance Bond and a Payment Bond on AGO Forms, with good and sufficient surety or sureties as required by the specifications, at the time the contract is executed.

E. It is hereby warranted that in the event award is made to the undersigned, there will be furnished under this contract or used in the performance of the work covered by this contract, only such unmanufactured articles, materials, and supplies as have been mined or produced in the United States, and only such manufactured articles, materials, or supplies mined, produced or manufactured, as the case may be, in the United States, except as indicated in the bid documents..

F. The bidder further agrees that if awarded the contract, he will commence work within ten (10) calendar days after notice to proceed date and that he will fully complete the work ready for use not later than <u>410</u> <u>calendar days</u> after notice to proceed date.

ADDRESS		
PHONE		
FAX		
EMAIL		
BY		
	SIGNATU	IRE
PRINTED NAM	E	
TITLE		
STATE OF ALA	BAMA	

NOTES:

All bidders must be licensed under the provisions of Title 34, Chapter 8, Code of Alabama, 1975, as amended.

On projects bid at \$50,000.00 or more, the bidder must include his license number on the bid form in the prescribed place and on the outside of the envelope containing the bid, or otherwise the bid <u>will</u> <u>not</u> be considered.

Bid Prices do not include Sales or Use Taxes but these taxes are identified in the Estimated Sales Tax Amount section of this bid form.

Northport FMS#9 Renovations Northport, AL

SECTION 00 43 00 - FORM OF BID BOND

BID BOND

A completed/executed Standard Bid Bond form (Building Commission Form, AIA Form, GSA Standard Form, etc.) [A Power of Attorney is <u>REQUIRED</u> for all Bid Bonds] or a certified check made payable to the Armory Commission of Alabama in an amount not less than five (5) percent of the Contractor's bid, but in no event more than ten thousand dollars (\$10,000.00), must accompany all bids greater than \$50,000.00.

SECTION 00 43 25 - SUBSTITUTION REQUEST FORM DURING BIDDING

(Revision Date - 14 Jan 21)

(BIDDERS SHALL USE THIS FORM FOR SUBMITTING SUBSTITUTION REQUESTS DURING BIDDING. OTHER FORMS OF SUBSTITUTION REQUESTS WILL NOT BE CONSIDERED. THIS FORM MUST BE RECEIVED BY ARCHITECT NOT LATER THAN 7 WORKING DAYS PRIOR TO BID OPENING DATE)

Project: Northport FMS #9 Renovations			Substitution Request Number:			
IFB Project No.: IFB #: AC-22-B-0004-S			Re:			
From [.]						
Specification	n Title:				Section:	
Description:			Page:		Article/Paragraph:	
Proposed Substitution			9000029972-00-25		enne Lono Roca Mandologi Scologi Picco o	
Manufacture	er:	Address	s:		Phone:	
Trade Name				Mo	del No.:	
Installer:		Address:		atat:	Phone:	
History:	New Product	1 – 4 years old	5 – 1) years old	Exceeds 10 years old	
Differences	between proposed	d substitution and	d specified	product:		
Reason for r	not providing spec	cified item:				
Similar Insta	llation:					
Project:		Architect:				
Address:		Owner: Data Insta	llod			
Proposed su Explain	bstitution affects	other parts of W	ork:No	Yes		
Savings to C	wner for acceptin	g substitution (in	nclude roug	gh order of r	magnitude): \$	
Proposed su [Add] [Dedi	bstitution change uct] d	es Contract Time ays.	(include ro	ugh order o	f magnitude):NoYes	
Supporting [Data Attached:					
Drawings	Product Data	Samples	Tests	Reports		
SUBSTITUTI	ON REQUEST (BI	DDING PHASE)			00 43 25-	

The Undersigned Certifies:

Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.

Same warranty will be furnished for proposed substitution as for specified product.

Same maintenance service and source of replacement parts, as applicable, is available.

Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.

Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.

Proposed substitution does not affect dimensions and functional clearances.

Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted By:	Signed By:	 	
Firm:			
Address:			
Telephone:	Fax:		
E-mail:	Website:		
Attachments:			
4 T			

SECTION 00 45 19 - DISCLOSURE STATEMENT



State of Alabama Disclosure Statement

(Required by Act 2001-955)

ENTITY COMPLETING FORM	
ADDRESS	
CITY, STATE, ZIP	TELEPHONE NUMBER
STATE AGENCY/DEPARTMENT THAT WILL RECEIVE GOODS, SERVICES, OR IS RESPONSIBL Armory Commission of Alabama	E FOR GRANT AWARD
ADDRESS 1720 Congressman W. L. Dickinson Drive	
Montgomery, AL 36109	TELEPHONE NUMBER (334) 271-7274
This form is provided with:	Invitation to Bid Grant Proposal
Have you or any of your partners, divisions, or any related business Agency/Department in the current or last fiscal year? Yes No If yes, identify below the State Agency/Department that received th vided, and the amount received for the provision of such goods or s	a units previously performed work or provided goods to any State e goods or services, the type(s) of goods or services previously pro- services.
Have you or any of your partners, divisions, or any related business Agency/Department in the current or last fiscal year? Yes No If yes, identify the State Agency/Department that awarded the gran	a units previously applied and received any grants from any State t, the date such grant was awarded, and the amount of the grant.
STATE AGENCY/DEPARTMENT DATE GRAI	AMOUNT OF GRANT
 List below the name(s) and address(es) of all public officials/pub any of your employees have a family relationship and who may Identify the State Department/Agency for which the public official 	lic employees with whom you, members of your immediate family, or directly personally benefit financially from the proposed transaction. s/public employees work. (Attach additional sheets if necessary.)
NAME OF PUBLIC OFFICIAL/EMPLOYEE ADD	STATE DEPARTMENT/AGENCY

SECTION 00 45 19 - DISCLOSURE STATEMENT

2. List below the name(s) and address(es) of all family members of public officials/public employees with whom you, members of your immediate family, or any of your employees have a family relationship and who may directly personally benefit financially from the proposed transaction. Identify the public officials/public employees and State Department/Agency for which the public officials/public employees work. (Attach additional sheets if necessary.)

NAME OF FAMILY MEMBER	ADDRESS	NAME OF PUBLIC OFFICIAL/ PUBLIC EMPLOYEE	STATE DEPARTMENT/ AGENCY WHERE EMPLOYED
If you identified individuals in officials, public employees, a grant proposal. (Attach addi	n items one and/or two above, descr and/or their family members as the r tional sheets if necessary.)	ibe in detail below the direct financial ben esult of the contract, proposal, request for	efit to be gained by the public r proposal, invitation to bid, or
	· · · · · · · · · · · · · · · · · · ·		
Describe in detail below any oublic official or public emple additional sheets if necessa	indirect financial benefits to be gain oyee as the result of the contract, pro ry.)	ed by any public official, public employee, oposal, request for proposal, invitation to l	and/or family members of the bid, or grant proposal. (Attach
List below the name(s) and a posal, invitation to bid, or gra	address(es) of all paid consultants a ant proposal:	nd/or lobbyists utilized to obtain the contra	act, proposal, request for pro-
NAME OF PAID CONSULTANT/LC	DBBYIST F	ADDRESS	
· · ·		· · · · · · · · · · · · · · · · · · ·	
		- 22-000	
By signing below, I certify to the best of my knowledg to exceed \$10.000.00. is an	under oath and penalty of perjury ge. I further understand that a civi plied for knowingly providing inco	that all statements on or attached to th I penalty of ten percent (10%) of the am rrect or misleading information.	is form are true and correc ount of the transaction, no

Signature Date
Notary's Signature Date Date Date Notary Expires

Act 2001-955 requires the disclosure statement to be completed and filed with all proposals, bids, contracts, or grant proposals to the State of Alabama in excess of \$5,000.

00 52 00 - CONSTRUCTION CONTRACT FORM

STATE OF ALABAMA

THE ARMORY COMMISSION OF ALABAMA

CONSTRUCTION CONTRACT

OWNER:

THE ARMORY COMMISSION OF ALABAMA P.O. BOX 3711 MONTGOMERY, ALABAMA 36109-0711

CONTRACTOR:

(Contractor's Name) (Street Address) (City, State Zip)

CONTRACT FOR: (Project Name)

CONSTRUCTION LOCATION: (Project City, State)

AMOUNT: (Dollar Amount)

PAYMENT TO BE MADE BY: STATE OF ALABAMA

FEDERAL:

STATE:

00 52 00 - CONSTRUCTION CONTRACT FORM

CONTRACT AGREEMENT FOR CONSTRUCTION

THIS AGREEMENT, entered into this (day) day of (month) (year) by and between The Armory Commission of Alabama (hereinafter called the Owner), and (Contractor Name)(hereinafter called the Contractor).

WITNESSETH that the Owner and the Contractor, in consideration of premises of the mutual covenants, considerations, and agreements herein contained, agree as follows:

STATEMENT OF WORK: The Contractor shall furnish all labor and materials and perform all work for (**Project Name**) in strict and entire conformity with the plans and specifications dated (**Date**) prepared by (**Architect/Engineer**) and approved by The Armory Commission, including Addenda thereto numbered (**Number**), all of which are hereby made a part of this agreement as fully and to the same effect as if the same had been set forth at length in the body of this Agreement.

TIME OF COMPLETION: The work shall be commenced on a date to be specified in a written proceed order of the Contracting Officer and shall be completed within (# of Days) from and after said date as provided in the Contract documents.

00 52 00 - CONSTRUCTION CONTRACT FORM

COMPENSATION TO BE PAID: The Owner will pay and the Contractor will accept in full consideration for the performance of the Work, subject to additions and deductions (including liquidated damages) as provided in the Contract Documents, the sum of (Contract Amount), being the amount of the Contractor's bid for the aforesaid work, including bid items (Awarded Items). The Contractor and the Owner for themselves, their successors, executors, administrators, and assigns, hereby agree to the full performance of the covenants herein contained.

COMPLIANCE WITH ADDITIONAL STATE REQUIRED CLAUSES: By signing this contract, the Contractor hereby certifies compliance and agreement with the following clauses required by the State of Alabama:

1. In compliance with Act No. 2012-491, the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the state of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom;

2. In compliance with Act 2016-312, the Contractor hereby certifies that it is not currently engaged in, and will not engage in, the boycott of a person or an entity based in or doing business with a jurisdiction with which this state can enjoy open trade;

3. In compliance with the merit system exclusion clause, the Contractor understands

3

00 52 00 - CONSTRUCTION CONTRACT FORM

and agrees that the Contractor is not to be considered a State of Alabama merit system employee and is not entitled to any benefits of the State Merit System;

4. By entering into this contract, the Contractor is not an agent of the state, its officers, employees, agents or assigns. The Contractor is an independent entity from the State and nothing in this agreement creates an agency relationship between the parties.

IN WITNESS WHEREOF, the Parties hereto and on the day and year first above written have executed this Agreement in Three counterparts, each of which shall without proof or accounting for the other counterparts, be deemed as original thereof.

This Contract was let in accordance with the provisions of Title 39, Code of Alabama 1975 as amended, and applicable sections of Department of Defense Armed Services Procurement Regulation. The terms and commitments of this Contract do not constitute a debt of the State of Alabama in violation of Article 11, Section 213 of the Constitution of Alabama, 1901, as amended by Amendment Number 26.

00 52 00 - CONSTRUCTION CONTRACT FORM

WITNESSES:

CONTRACTING PARTIES:

(Contractor's Name) Contractor

(Signature)

This contract has been reviewed for legal form and complies with all applicable laws, rules, and regulations of the State of Alabama governing these matters.

JAMES R. HOUTS Deputy Attorney General

This contract has been reviewed for and is approved as to content.

MARK A. WEEKS State Property & Disbursing Officer

<u>NOTE</u>: If the Contractor is a corporation, witnesses are not required, but the annexed certificate must be completed. Type or print names under all signatures.

00 52 00 - CONSTRUCTION CONTRACT FORM

ATTEST:

The Armory Commission of Alabama

MARK A. WEEKS Secretary The Armory Commission SHERYL E. GORDON Major General, ALNG The Adjutant General

ATTEST:

APPROVED:

JOHN H. MERRILL Secretary of State of Alabama KAY IVEY Governor, State of Alabama

00 52 00 - CONSTRUCTION CONTRACT FORM

CERTIFICATE

I,	, certify that I a	m the	of the corporation
named as Contra	ctor herein; that <u>xx</u>	XXXXXXXX.	, who signed this contract on
behalf of the Con	tractor, was then the _	xxxxxxxxx	_ of said corporation; that said
Contractor was d	uly signed for and in b	ehalf of said co	prporation by authority of its
governing body, a	and is within the scope	of its corporat	e powers.

(SEAL)

<u>NOTE</u>: Contractor, if a corporation, should cause the above certificate to be executed under its corporate seal. <u>THE SAME OFFICER SHALL NOT EXECUTE BOTH THE CONTRACT AND THE CERTIFICATE</u>.

<u>NOTE</u>: In the event that the Contractor is not a corporation, the signature page must be witnessed by two individuals and this page may be left blank.

SECTION 00 61 13 - PERFORMANCE BOND FORM

AGO Form 215 PERFORMA (16 Apr 80) (MOD JUL 87) (See Instruction (Page 1 of 3)	NCE BOND DATE BOND EXECUTED ons Attached)
PRINCIPAL (Legal name and business address)	TYPE OF ORGANIZATION ("X" Out)
	Individual Partnership Joint Venture Corporation State of Incor- poration
SURETY(IES) (Name and business address)	
Penal Sum of Bond (Express in words & figures)	
Contract Number	Contract Date
KNOW ALL MEN BY THESE PRESENTS, That hound to the Armory Commission of Alabama in hind ourselves, our heirs, executors, administrators That, where the Sureties are corporations acting as sum "jointly and severally" as well as "severally" actions against any or all of us, and for all other pur- with the Principal, for the payment of such sum on but if no limit of liability is indicated, the limit of liability is indicated, the limit of liability is indicated, the limit of liability	we, the Principal and Surety(ies) hereto, are firmly the above penal sum for the payment of which we s, and successors, jointly and severally: <i>Provided</i> , co-sureties, we, the Sureties, bind ourselves in such only for the purpose of allowing a joint action or rposes each Surety binds itself, jointly and severally ify as is set forth opposite the name of such Surety, ability shall be the full amount of the penal sum.
THE CONDITION OF THIS OBLIGATION IS S contract identified above:	SUCH, that whereas the Principal entered into the
NOW, THEREFORE, if the Principal shall:	
(a) Perform and fulfill all the undertaking said contract during the original term of said contra- by the Armory Commission of Alabama through its Surety(ies), and during the life of any guaranty requ fulfill all the undertakings, covenants, terms, condit modifications of said contract that may hereafter Surety(ies) being hereby waived; and	s, covenants, terms, conditions, and agreements of act and any extensions thereof that may be granted s Contracting Officer, with or without notice to the uired under the contract, and shall also perform and ions, and agreements of any and alt duly authorized r be made, notice of which modifications to the

AGO Form 215 (16 Apr 80) (Page 2 of 3)

(MOD Jul 87)

- (b) PROVIDED, further, that upon the failure of the said PRINCIPAL to promptly and efficiently prosecute said Work, in any respect, in accordance with the Contract Documents, the above bound Surety(ies) shall take charge of said work and complete the Contract at his/their own expense, pursuant to its terms, receiving, however, any balance of the funds in the hands of said The Armory Commission of Alabama due under said contract.
- (c) The Invitation for Bids, Instructions to Bidders, Proposal, General and Special Conditions of the Contract, Detailed Specification Requirements, and Drawings, and the Contract Agreement hereinbefore referred to, and the Bond for the Payment of Labor, Materials, Food-stuffs, or Supplies executed under the provision of Chapter 1, Title 39, Alabama Code of 1975, are made a part of this obligation, and this instrument is to be construed in connection therewith.
- (d) If the said contract is subject to the Miller Act, as amended (40 U.S. Code 270a-270c), pay to the U.S. of America the full amount of the taxes imposed by the U.S. Government which are collected, deducted, or withheld from wages paid by the Principal in carrying out the construction contract with respect to which this bond is furnished; then the above obligation shall be void and of no effect.

IN WITNESS WHEREOF, the Principal and Surety(ies) have executed this performance bond and have affixed their seals on the date set forth above.

			PRINCIPA	l.		
Sig	nalurcs(s)	l.	(Scal)	2.	(Seal)	Corporate
Na 1	mc(s) & l'itle(s) Types)					Scal
		·····	CORPORATE SUF	ETY(IES)		
	Name & Address (Typed)		Stat	e of Inc.	Liability Limit	
Surrey A	Signature(s) 1.	2.			Corporate Seal
U .	Names(s) & Title(s) (Typed)	2 1.	2.			
	Name & Address (Typed)		State	e of Ine.	Liability Limit	
Suncty B	Signature(s) 1.	2.			Corporate Seal
•	Names(s) & Title(s) (Typed)	٤ ١	2.		andre and a second a	1

0	Bond	Rate Per Thousand	Total
	Premium	1000 A RE REPORTE AT L	a da da compositiva d
0.0000			

AGO Form 215	(16 Apr 80)	(Page 3 of 3)
(MOD JUL	87)	INSTRUCTIONS

- This form is authorized for use in connection with contracts for construction work or the furnishing of supplies or services. There shall be no deviation from this form without approval by the Armory Commission of Alabama.
- 2. The full legal name and business address of the Principal shall be inserted in the space designated "Principal" on the second page of this form. The bond shall be signed by an authorized person. Where such person is signing in a representative capacity (e.g., an altorney-in-fact), but is not a member of the firm, partnership, or joint venture, or an officer of the corporation involved, evidence of his authority must be furnished.
- 3. Corporations executing the bond as sureties must be licensed to do business in the State of Alabama. Where more than a single corporate surety is involved, their names and addressed (city and state) shall be inserted in the spaces (Surety A, Surety B) headed "CORPORATE SUETY(IES)", and in the space designated "SURETY(IES)" on the front page of this form, only the letter identification of the Sureties shall be inserted. Evidence of authority must be attached.
- Corporations executing the bond shall affix their corporate seals. Individuals shall execute the bond opposite the word "Seal".
- 5. The name of each person signing this performance bond should be typed in the space provided.

and the second	
[1] A. Martin and M. Martin and M Martin and M. Martin an Martin and M. Martin and	an teach ann an an an an an ann an teach ann an tha ann an teach ann an ann ann ann an ann ann an teach ann an Ann ann an teachar ann an ann ann ann ann ann ann ann an
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	(a) preserve of the second state of the sec
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an an an an ann an an an an ann an an an	
SECTION 00 61 16 - PAYMENT BOND FORM

AGO Form 214	PAYMENT BOND	Date bond executed
5 AUG 82 (MOD 29 JL	JL 87)	
Page 1 of 2	(See Instructions Attache	:d)
PRINCIPAL (Legal næ	ne and business address)	TYPE OF ORGANIZATION ("X" Out) Individual Partnership Joint Venture Corporation State of Incorporation
SURETY (IES) (Name	and Business Address)	
Penal Sum of Bond (Ex	press in words & figures)	
Contract No.:		Contract Date:
KNOW ALL MEN BY	Y THESE PRESENTS, That we	, the Principal and Surety(ies) hereto, are

firmly bound to the Armory Commission of Alabama in the above penal sum for the payment of which we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally: *Provided*, That, where the Sureties are corporations acting as co-sureties, we, the Sureties, bind ourselves in such sum "jointly and severally" as well as "severally" only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each Surety binds itself, jointly and severally with the Principal, for the payment of such sum only as is set forth opposite the name of such Surety, but if no limit of liability is indicated, the limit of liability shall be the full amount of the penal sum.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal entered into the contract identified above:

NOW, THEREFORE, if the Principal shall promptly make payment to all persons supplying labor, equipment or supplies, and material in the prosecution of the work provided for in said contract and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the Surety(ies) being hereby waived, then the above obligation shall be void and of no effect; otherwise to remain and be in full force and effect.

PROVIDED, further, in the event that the said Principal, as such Contractor, shall fail to make prompt payment to all persons supplying him or them with labor, materials, feed-stuffs, or supplies for or in the prosecution of the Work provided for in such Contract, the above bound Surety(ies) shall be liable for the payment of reasonable attorney's fees incurred by successful claimants or plaintiffs in suits on said bond as provided in Chapter 1, Title 39, Code of Alabama 1975.

PROVIDED, further, that said Principal and Surety hereby agree and bind themselves to the mode of service described in Chapter 1, Title 39, Code of Alabama 1975, and consent that such service shall be the same as personal service on said Principal or Surety.

			PRINCI	PAL		
Sign	aturv(s)	1.	(Scal)	2.	(Seat)	Corporate
Name(s) & Title(s) (Typed)						Seal
		C	ORPORATE SI	URETY(IES)		
	Name & Address (Typed)			State of Inc.	Liability Limit	
A vianus	Signature(s)	1.		2.		Corporate Seal
20	Name(s) & Title(s) (Typed)	1.		2.		
	Name & Address (Typed)			State of Inc.	Liability Limit	
iurciy B	Signature(s)	1.		2.		Corporate Seal
	Name(s) & Title(s) (Typed)	1.	1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	2.		

INSTRUCTIONS

- This form, for the protection of persons supplying labor and material, shall be used whenever a
 payment bond is required under the act of Aug 24, 1935, 49 Stat. 793, as amended (40 U.S.C.
 270a-270e). There shall be no deviation from this form without approval by the Armory
 Commission of Alabama.
- 2. The full legal name and business address of the Principal shall be inserted on the space designated "Principal" on this form. The bond shall be signed by an authorized person. Where such person is signing in a representative capacity (e.g. an attorney-in-fact), but is not a member of the firm, partnership, or joint venture, or an officer of the corporation involved, evidence of his authority must be furnished.
- 3. Corporations executing the bond as sureties must be licensed to do business in the State of Alabama. Where more than a single corporate surety is involved, their names and addresses (city and state) shall be inserted in the spaces (Surety A, Surety B, etc.) headed "CORPORATE SURETY(IES)", and in the space of the Sureties shall be inserted. Evidence of authority must be attached.
- Corporations executing the bond shall affix their corporate seals. Individuals shall execute the bond opposite the word "Seal".
- 5. The name of each person signing this payment bond should be typed in the space provided.

END OF SECTION

SECTION 00 62 76 - CONTRACTOR'S PERIODICAL REQUEST FOR PARTIAL PAYMENT

CONTRACTORS PERIODICAL REQUEST FOR PARTIAL PAYMENT (Rev 12 MAR 2019)

PROJECT TITLE:		LOCATION:				
CONTRACT NUMBER:		NOTICE TO PROCEED DATE:				
OWNER: THE ARMORY COMMISSIO	N OF ALABAMA, P.O. BOX					
CONTRACTOR:						
AODRESS:						
FEDERAL IDENTIFICATION NUMBER:		INVOICE DATE:				
DADTIAL DAYMENT NO						
	TINAL Pay ned: 169					
Item # Description		Contract Price	Percent Complete	Amount Complete		
1						
2						
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29			[]			
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32] [
33						
34						
35						
		\$0.00	-	sn on 1		
Net Total of ALL		\$ 5.00		\$0.00		
Change Orders/Supplements No.	to					
TOTAL CONTRACT TO DATE		\$0.00		\$0.00		
				1 505 Street State		

Page: 1 of 2

tored Materials: (List)	% Completed	
mount of Stored Materials (*)	\$0.00	\$0.00
otal Completed & Stored Materials		\$0.00
ess Retainage (5% up to 50% of Contract Amount)		\$0.00
otal Due		\$0.00
otal Previous Payments		
ALANCE DUE THIS PAYMENT		\$0.00
	· · · · · · · · · ·	
as stored materials are incorporated in the finished work, their value shall be deducted t	from Previous Stored Materials.	
ertify that the above account is correct, just and that payment therefore has not yet bee	en received.	
worn to and subscribed before me this		
day of 20	CONTRACTOR	
(Do NOT Type Above Information - Handwritten Date Info ONLY)		

(Notary Public)		(Signature)
	Printed Name:	
My Commission Expires:	Title:	

VERIFICATIONS AND APPROVALS

Checked by:

Reviewed by:

Project Manager

Architect/Architect's Representative

Approved by:

Contracting Officer/Contracting Officer's Representative

(Rev 12 MAR 2019)

Page: 2 of 2 00 62 76 - 2

Date:

Date:

Date:

CHANGE ORDERDETAIL SHEET

FOR PARTIAL PAY REQUEST NO.

CO #	Description		Contract Price	Percent Complete	Amount Complete
			2		
2/3					
Net	t Total of ALL Change	TO #	\$0.00		\$0.00
Gruers		10 #			\$0.00
				Page:	<u>1</u> of <u>1</u>

00 62 76 - 3



THE ARMORY COMMISSION OF ALABAMA P.O. Box 3711 MONTGOMERY, ALABAMA 36109-0711

State Property and Disbursing Office

May 27, 2014

MEMORANDUM FOR ALL Architect-Engineer Firms Preparing Bid Documents for Armory Commission of Alabama and ALL Project Managers

SUBJECT: Act 2013-205, Certificate of Exemption from Sales and Use Tax for Armory Commission Contracts

1. Act 2013-205 was signed into law on May 9,2013, granting the Alabama Department of Revenue (ADOR) the authority to issue certificates of exemption from sales and use taxes for construction projects for certain governmental agencies. Enclosed are a Memo from Alabama Department of Revenue regarding the Sales Tax Exemption guidance and a copy of Act 2013-205.

2. A brief summary of Act 2013-205 as it pertains to Armory Commission Contracts is provided below:

- a. ADOR shall issue certificates of exemption from sales and use tax to The Armory Commission of Alabama for each tax exempt project. The Armory Commission shall apply for certificates of exemption for each project. The contractor must also apply for certificates of exemption for each project for which they receive a contract.
- b. Certificates of exemption shall only be issued for contracts entered into (awarded) on or after 1JAN14.
- c. Certificates shall only be issued to contractors licensed by the State Licensing Board for General Contractors or any subcontractor working under the same contract.
- d. Items eligible for exemption from sales and use tax are building materials, construction materials and supplies and other tangible personal property that become part of the structure per the written construction contract.
- e. ADOR will handle the administration of certificates of exemption and the accounting of exempt purchases. ADOR will have the ability to levy fines and may bar the issuance or use of certificates of exemption upon determination of willful misuse by the contractor or a subcontractor.
- f. The contractor shall account for the tax savings on the bid form by providing the estimated sales taxes for each item in the appropriate area on the bid form.

3. Contractors will NOT include sales taxes in their bids on the bid proposal form. Contractors <u>MUST</u> however include the estimated sales taxes for each listed bid item in the area identified on their bid proposal forms. This "accounting" for sales tax on the bid proposal form is required by Act 2013-205, Section 1 (g). Bid proposal forms with base bids and separate alternate bids will follow this procedure. The bid forms shall be modified for each project by the architect or engineer as appropriate to insure that EACH bid item is listed with NO sales taxes and then a separate area identifying the

estimated sales taxes for EACH of these items is identified and listed on the bid proposal form.

4. Failure of the contractor to complete the attachment to the bid proposal form indicating the sales tax as required by Act 2013-205, Section 1 (g) shall render the bid non-responsive.

5. Architects will address these tax reporting requirements in all future pre-bid conferences and will further prepare addenda which will inform all current plan holders of this tax exemption policy for the upcoming bid openings in June 2014.

6. It is the responsibility of the "contractor" to ensure they comply with Act 2013-205.

7. All future projects will include this information in the Instructions to Bidders. Should you have additional questions or need further information, please contact me by email mark.a.weeks3.nfg@mail.mil or phone (334) 271-7275.

Respectfully,

Enclosures

MARK A. WEEKS Contracting Officer and Secretary, The Armory Commission of Alabama



State of Alabama Department of Revenue (www.revenue.alabama.gov) 50 North Ripley Street Montgomery, Alabama 36132

MICHAEL E. MASON Assistant Commissioner JOE W. GARRETT, JR. Deputy Commissioner CURTIS E. STEWART Deputy Commissioner

Alabama Department of Revenue NOTICE

Tax Guidance for Contractors, Subcontractors and Alabama Governmental Entities Regarding Construction-related Contracts

Legislative Act 2013-205 requires the Department of Revenue to issue Form STC-1, *Sales and Use Tax Certificate of Exemption for Government Entity Projects*, to all contractors and subcontractors working on qualifying governmental entity projects once the Form ST: EXC-01 is approved.

Each exempt entity, contractor and subcontractor must make application for qualification of the exemption using Form ST: EXC-01 for each tax-exempt project. The application is available on the department's website at <u>http://revenue.alabama.gov/salestax/ST-EXC-01.pdf</u>. Applications should be submitted directly to the Sales and Use Tax Division Central Office, P.O Box 327710, Montgomery, AL 36132-7710.

The sales and use tax exemption provided for in Act 2013-205 applies to the purchase of building materials, construction materials and supplies, and other tangible personal property that become part of the structure pursuant to a qualifying contract entered into on or after January 1, 2014. Qualifying projects and contracts are those generally entered into with the following governmental entities, unless otherwise noted: the State of Alabama, a county or incorporated municipality of Alabama, an Alabama public school, or an Alabama industrial or economic development board or authority already exempt from sales and use taxes. **Please note that contracts entered into with the federal government and contracts pertaining to highway, road, or bridge construction or repair do not qualify for the exemption provided for in Act 2013-205.** [Reference: Sales and Use Tax Division Administrative Rule 810-6-3-.77 *Exemption for Certain Purchases by Contractors and Subcontractors in Conjunction with Construction Contracts with Certain Governmental Entities*.]

The Alabama Department of Revenue will assign each contractor and sub-contractor a consumers use tax account, if one is currently not in place, at the time the Form STC-1, Sales and Use Tax Certificate of Exemption for Government Entity Projects, is issued.

Contractors and sub-contractors for qualifying projects will be required to file monthly consumers use tax returns and report all exempt purchases for ongoing projects, as well as all taxable purchases on one return. These returns are required to be filed through the department's online tax return filing and payment portal, My Alabama Taxes (<u>https://myalabamataxes.alabama.gov</u>).

As another option for these types of contracts, as well as with other contracts entered into with other types of exempt entities, the Form ST:PAA1, *Purchasing Agent Appointment*, may be used. However, please be advised that the use of the Form ST:PAA1 option will require the exempt entity to be invoiced directly and pay for directly from their funds any construction and building material and supply purchases.

For additional information concerning this guidance, taxpayers should contact Sales and Use Tax Division representative Thomas Sims at 334-242-1574 or by email at <u>Thomas.Sims@revenue.alabama.gov</u>.

SALES TAX ABATEMENT

ACT 2013 - 205

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- 3 By Representative DeMarco
- 4 RFD: Ways and Means Education
- 5 First Read: 07-MAR-13



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ENROLLED, An Act,

Relating to construction projects of the State of 3 Alabama, counties, municipalities, local boards of education, 4 industrial development boards, and other governmental entities 5 which are exempt from the payment of sales and use taxes on 6 the purchase of building materials and construction materials 7 to be included in construction projects of the governmental 8 entity; to provide for the Department of Revenue to grant 9 certificates of exemption from sales and use taxes to 10 contractors and subcontractors licensed by the State Licensing 11 Board for General Contractors for the purchase of building 12 materials and construction materials to be used in the 13 construction of a building or other project for the 14 governmental entity, with the exception of any highway, road, 15 or bridge project; to provide for accounting for purchases and 16 enforcement for violation of the act; and to authorize the 17 Department of Revenue to adopt rules to implement the act. 18 BE IT ENACTED BY THE LEGISLATURE OF ALABAMA: 19

20 Section 1. (a) For the purposes of this act, the 21 term "governmental entity" means any governmental entity or a 22 political subdivision, department, or agency of a governmental 23 entity or a board, commission, or authority of a governmental 24 entity which is tax exempt from sales and use taxes by virtue 25 of its governmental status, including, but not limited to, all

Page 1

1	of the following: The State of Alabama; a county, a
2	municipality, an industrial or economic development board or
3	authority, and an educational institution of any of the
4	foregoing including a public college or university, a county
5	term "governmental entity" means the State of Alabama and its
6	political subdivisions, including a county, a municipality,
7	and an industrial or economic development board or authority.
8	A governmental entity shall also include an educational
9	institution of any of the foregoing Alabama political
10	subdivisions including a public college or university, a
11	county or city board of education, and the State Board of
12	Education.
13	(b) (1) The Department of Revenue shall issue a
14	certificate of exemption to the governmental entity for each
15	tax exempt_project.
16	(b) (2) The Department of Revenue shall grant a
17	certificate of exemption from state and local sales and use
18	taxes to any contractor licensed by the State Licensing Board
19	for General Contractors, or any subcontractor working under
20	the same contract, for the purchase of building materials,
21	construction materials and supplies, and other tangible
22	personal property that becomes part of the structure that is
23	the subject of a written contract for the construction of a
24	building or other project, not to include any contract for the
25	construction of any highway, road, or bridge, for and on

HB419

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behalf of a governmental entity which is exempt from the
 payment of sales and use taxes.

3 (c) The use of a certificate of exemption for the purchase of tangible personal property pursuant to this 4 section shall include only tangible personal property that 5 6 becomes part of the structure that is the subject of the construction contract. Any contractor or subcontractor 7 purchasing any tangible personal property pursuant to a 8 9 certificate of exemption shall maintain an accurate cost 10 accounting of the purchase and use of the property in the 11 construction of the project.

(d) A contractor who has an exemption from sales and
use tax for the purchase of materials to use on a government
project shall file, in a manner as prescribed by the
department, an annual report reports of all exempt purchases.
The annual report reports shall be filed as a prerequisite to
renewal of a certificate of exemption.

(e) (1) The department may assess any contractor or
subcontractor with state and local sales or use taxes on any
item purchased with a certificate of exemption not properly
accounted for and reported as required,

(2) Any contractor or subcontractor who
intentionally uses a certificate of exemption in violation of
this act shall, in addition to the actual sales or use tax
liability due, be subject to a civil penalty levied by the

Page 3

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HB419

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HB419

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1 department in the amount of not less than a minimum of two thousand dollars (\$2,000) or two times any state and local 2 3 sales or use tax due for the property and, based on the contractor's or subcontractor's willful misuse of the 4 certificate of exemption, may be barred from the use of any 5 6 certificate of exemption on any project for up to two years. 7 (f) The department may adopt rules to implement this 8 act in order to effectuate the purposes of this act and to provide for accurate accounting and enforcement of this act. 9 10 (g) In bidding the work on a tax exempt project, the 11 bid form shall provide for an accounting for the tax savings. 12 (h) The intent of this act is to lower the 13 administrative cost for the governmental entity, contractor, and subcontractor for public works projects. It is not the 14 intent of this act to change the basis for determining 15 professional services from fair market value, which may 16 17 include sales and use taxes. 18 Section 2. This act shall be operative for contracts entered into October 1, 2013 January 1, 2014, or thereafter, 19 20 and shall not apply to any contract entered into prior to January 1, 2014. In addition, this act shall not apply to any 21 22 contract change orders or contract extensions, including 23 revised, renegotiated, or altered contracts, when the original 24 contract was entered into prior to January 1, 2014. The

Page 4

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Department of Revenue may adopt rules to implement this act
 after the effective date of this act.
 Section 3. All laws or parts of laws which conflict
 with this act are repealed.
 Section 4. This act shall become effective October
 1, 2013, following its passage and approval by the Governor,
 or its otherwise becoming law.

HB419

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4		Speaker of the House of Rep	resentatives
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5	а.	Kay / very	
6		President and Presiding Offic	er of the Senate
7		House of Representativ	es
8	and was na	I hereby certify that the withi	n Act originated in
10		sed by the nouse of AFK-15, as	amended.
12		Clerk	a
13			
14			
15	Senate	07-MAY-13	Amended and Passed
16	House	09-MAY-13	Concurred in Sen-
17		· · · · · · · · · · · · · · · · · · ·	
	APPROVED	May 9, 2013	
	THE	5pm	
	11 ale	rt Bentley	
	GO	VERNOR	Alabama Secretary Of State
			Act Num: 2013-205
			Bill Num: H-419

Page 6

Recv'd 05/10/13 09:48amSLF

RD 2 CAL 20 20 20 I hereby certify that the Resolution as required in Section C of Act No. 81-889 PATRICK HARRIS, This Bill was referred to the Standing RE-COMMITTED Secretary and was acted upon by such Committee in session and is by order of the Committee returned therefrom with a favorable report by a vote of Chairperson was adopted and is attached to the Bill, 20 tostain NAYS & SENATE ACTION Committee of the Senate on dus/w nays 1) day of t.-... 1 w/amend(s) 11-1 ١., 5) RE-REFERRED L HB -[]-2 Committee YEAS <1 RD 1 RFD yeas SIC DATE: +-DATE: DATE: RF I HEREBY CERTIFY THAT THE RESOLUTION AS REQUIRED IN SECTION C OF ACT NO. 81-889 WAS ADOPTED AND IS ATTACHED TO THE BILL H.B. 419 JEFF WOODARD, Clerk HEREBY CERTIFY THAT THE NOTICE & PROOF IS ATTACHED JEFF WOODARD, Clerk AS REQUIRED IN THE GENERAL ACTS OF ALABAMA, 1975 ACT NO CONFERENCE COMMITTEE NAYS 6 HOUSE ACTION TO THE BILL, H.B. TO THE BILL, H.B. YEAS BY House Conferees 919.

00 62 78 INVENTORY OF STORED MATERIALS

INVENTORY OF STORED MATERIALS

Project:

For Period Ending_

	F	MATERIALS PRESENTLY STORED		LFUK FAKIJAL
	ш	MATERIALS USED THIS PERIOD		DICAL KEQUEN
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Contractor:	Α	DESCRIPTION		to be used as documentation to support value of PAYMENT.

Page of

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00 62 83 CONTRACTOR'S DRAW SCHEDULE

Date Prepared: _____

Project Name: _____

Contract Number: _____

Contractor: _____

Architect/Engineer: _____

This draw schedule is to be updated monthly and the most current version **MUST** be submitted with each Contractor's Periodical Request for Partial Payment.

			r		·····	
CURRENT MONTH/YEAR						
PROJECTED DRAW						
ACTUAL DRAW						
TOTAL A MOUNT OF DRAWS	0	0	0	0	0	0
CUBRENT MONTH/YEAR	<u>.</u>		r			
PROJECTED DRAW						
ACTUAL DRAW						
TOTAL AMOUNT OF DRAWS	0	0	0	0	0	0
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CURRENT MONTH/YEAR						
PROJECTED DRAW						
ACTUAL DRAW						
TOTAL AMOUNT OF DRAWS	0	0	0	0	0	0
CURRENT MONTH/YEAR						
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TOTAL A MOUNT OF DRAWS	0	. 0	0	0	0	0

00 63 56 - WEATHER DELAY DOCUMENTATION FORM (Revised 3 August 2021)

Fo: Seay Seay and 1115 South Co Montgomery, J P: (334) 263-517 F: (334) 263-517	I Litchfield, P.C. urt Street AL 36104 62 70	Contractor Name Contractor Address Contractor City, State Zip Contractor Phone Contractor Fax		
PROJECT: (Name and address)	Northport FMS#9 Renovations Northport, AL	CONTRACT NO.	ACC-0\$	
TO OWNER: (Name and address)	Armory Commission of Alaboma 1720 Cong. W. L Dickinson Dr. Montgomery, Alabama 36109	DATE OF ISSUANCE:		

-

NOTICE OF WEATHER DELAYS: FOR THE ______ (Month) OF <u>20</u> (Year):

This Monthly Notice is to document Weather Delays for the referenced project in order to formally present a Change Order Request for extension of the Contract Time.

The toble below defines the monthly anticipated adverse weather for the contract period for exterior work and is based upon National Weather Service Climatological Data for the geographic location for the Project.

MONTHLY ANTICIPATED	ADVERSE RAIN (in day	s) – CALENDAR DAYS
---------------------	----------------------	--------------------

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

Based on the above data for the geographic location of this Project, the monthly anticipated adverse weather calendar days for _____ (Month) is _____ (days).

From our Daily Project Reports and Recorded Weather Data, it has been determined that the Project experienced __ days of adverse weather resulting in a partial or complete stoppage of work. The total number of adverse days, of __ days exceeds the normal adverse weather days at this Project site for this month by __ days. Therefore we respectfully request that the Contract Time be extended by __ net days.

TOTAL NET DAYS REQUESTED FOR _____ (Month) OF 20__ (Year)

TOTAL NET DAYS REQUESTED FOR PROJECT TO DATE: _____ (Days)

TOTAL NET DAYS APPROVED BY OWNER FOR PROJECT TO DATE: _____ (Days)

NOTE: The purpose of this form is to document Adverse Weather Days during the course of the Project. It does not relieve the Contractor of his responsibility to complete the Project in a timely manner and as scheduled.

WEATHER DELAY DOCUMENTATION FORM

FORM OF ADVERTISEMENT OF COMPLETION

LEGAL NOTICE

In accordance with Chapter 1, Title 39, Code of Alabama, 1975, notice is hereby given that <u>Contractor</u> has completed the Contract for <u>Project Name</u>), <u>Contract #</u>, located at <u>City, State</u>, for the Armory Commission of Alabama, Owner, and have made request for final settlement of said Contract. All persons having any claim for labor, materials or otherwise in connection with this project should immediately notify the Armory Commission of Alabama, P.O. Box 3711, Montgomery, Alabama 36109-0711.

Contractor

Business Address

NOTE: This notice must be run once a week for four successive weeks. Proof of publication is required.

FORM of ADVERTISEMENT of COMPLETION

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CERTIFICATE OF PUBLICATION

STATE OF ALABAMA		
COUNTY OF		
Before me,		, a Notary Public, in
and for said County, personally appeared	V	
who duly sworn, deposes and says that he/s	she is the PUBLISHER o	f the
, a	newspaper published v	veekly in,
Count	y, Alabama, and that th	ne
a copy of which is attached hereto, was publishe	ed in said newspaper for	consecutive weeks,
commencing in the issue of	(d	ate), and ending in the issue of
(d	late).	
	Dublish	
	Publish	
Sworn to and subscribed before me this	day of	, 20
	10	
	Notary I	Public

AIA[®] Document G706[™] – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT:	(Name	and	address)
x			

TO OWNER: (Name and address)

ARCHITECT'S PROJECT NUMBER: 00000-00 **CONTRACT FOR:** General Construction CONTRACT DATED: January 07, 2005

OWNER: ARCHITECT: CONTRACTOR: SURETY: OTHER:

STATE OF: COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1.	Consent of Surety to Final Payment. Whenever		
	Surety is involved, Consent of Surety is		
	required. AIA Document G707, Consent of		
	Surety, may be used for this purpose		
Indicate	Attachment Ves No		

The following supporting documents should be attached hereto if required by the Owner:

- 1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
- 2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
- 3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

CONTRACTOR: (Name and address)

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public: My Commission Expires:

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AIA^* Document G706A * – 1994

Contractor's Affidavit of Release of Liens

PROJECT: (Name and address)	ARCHITECT'S PROJECT NUMBER:	OWNER:
x	00000-00 CONTRACT FOR: General	ARCHITECT:
	Construction	CONTRACTOR:
TO OWNER: (Name and address)	CONTRACT DATED: January 07, 2005	SURETY:
		OTHER:

STATE OF: COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

- 1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
- 2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: (Name and address)

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public: My Commission Expires:

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Consent Of Surety to Final Payment

PROJECT: (Name and address)	ARCHITECT'S PROJECT NUMBER: 00000-00	OWNER:
x	CONTRACT FOR: General Construction	ARCHITECT:
TO OWNER: (Name and address)	CONTRACT DATED: January 07, 2005	CONTRACTOR:
		SURETY:
		OTHER:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the (Insert name and address of Surety)

on bond of (Insert name and address of Contractor)

, CONTRACTOR, hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety of any of its obligations to (Insert name and address of Owner)

as set forth in said Surety's bond,

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date: (Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

Attest: (Seal):

(Printed name and title)

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00 65 20 - CERTIFICATE OF FINAL COMPLETION FORM (Revised 3 August 2021)

CERTIFICATE OF	FINAL COMPLETION	Distribution	n to:
Seay Seay and 1115 South Cou Montgomery, A P: (334) 263-516 F: (334) 263-517	Litchfield urt Street L 36104 2 0	OWNER ARCHITECI CONTRAC OTHER	tor
PROJEC1: (Name and address)	Northport FMS #9 Renovations Northport, AL	CONTRACT NO.	ACCS
TO OWNER: (Name and address)	Armory Commission of Alabama 1720 Cong. W. L Dickinson Dr. Montgomery, Alabama 36109	TO CONTRACTOR: (Name and address)	xxxxxxxxxxxxxxxx xxxxxxxxxxxxxxx xxxxxx
DATE OF ISSUANCE:	DATE	CONTRACT TYPE: CONTRACT DATE:	General Construction MONTH DAY, YEAR
PROJECT OR DESIGNATED PORTION SHALL INCLUDE: Restoration of the Brundidge Readiness Center located in Brundidge, AL. Scope of work includes civil site modification; exterior ond interior architectural finish upgrades; and mechanical, plumbing, and electrical upgrades. The Work performed under this Contract has been reviewed and found, to the Architect's best knowledge, information and belief, to be complete. Final Completion is the stage in the progress of the Work when the Work or designated portion thereof is complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use. The Date of Final Completion of the Project designated above is hereby established as the date of execution by the Owner as stated in the General Conditions, which is also the date of commencement of applicable warranties required by the Cantract Documents.			
Seav Seav and	Litchfield P.C.	cumpleteu.	
Architect:	By: NAME		Date;
Contractor Nar	ne		Data
Canifactor:	BY: NAME (F	KUM CUNIKACI)	Dale;
The Owner accepts the Work as complete and will assume full possession thereof at TIME on DATE.			
Armory Commi	ssion of Alabama	1-12-12 	
Owner:	By: AC Repr	esentative Name	Date:
GENERAL CONTRACTOR'S	B. C. Project No.		
-----------------------------	-------------------		
ROOFING GUARANTEE			

Project Name & Address	Project Owner(s) & Address	

General Contractor's Name, Address, & Telephone Number	EFFECTIVE DATES OF GUARANTEE	
	Date of Acceptance:	
	Date of Expiration:	

- 1. The General Contractor does hereby certify that the roofing work included in this contract was installed in strict accordance with all requirements of the plans and specifications and in accordance with approved roofing manufacturer's recommendations.
- 2. The General Contractor does hereby guarantee the roofing and associated work including but not limited to all flashing and counter flashing both composition and metal, roof decking and/or sheathing; all materials used as a roof substrate or insulation over which roof is applied; promenade decks or any other work on the surface of the roof; metal work; gravel stops and roof expansion joints to be absolutely watertight and free from all leaks, due to faulty or defective materials and workmanship for a period of five (5) years, starting on the date of substantial completion of the project. This guarantee does not include liability for damage to interior contents of building due to roof leaks, nor does it extend to any deficiency which was caused by the failure of work which the general contractor did not damage or did not accomplish or was not charged to accomplish.
- 3. Subject to the terms and conditions listed below, the General Contractor also guarantees that during the Guarantee Period he will, at his own cost and expense, make or cause to be made such repairs to, or replacements of said work, in accordance with the roofing manufacturers standards as are necessary to correct faulty and defective work and/or materials which may develop in the work including, but not limited to: blisters, delamination, exposed felts, ridges, wrinkles, splits, warped insulation and/or loose flashings, etc. in a manner pursuant to the total anticipated life of the roofing system and the best standards applicable to the particular roof type in value and in accordance with construction documents as are necessary to maintain said work in satisfactory condition, and further, to respond on or within three (3) calendar days upon proper notification or leaks or defects by the Owner or Architect.

- A. Specifically excluded from this Guarantee are damages to the work, other parts of the building and building contents caused by: (1) lightning, windstorm, hailstorm and other unusual phenomena of the elements; and (2) fire. When the work has been damaged by any of the foregoing causes, the Guarantee shall be null and void until such damage has been repaired by the General Contractor, and until the cost and expense thereof has been paid by the Owner or by the responsible party so designated.
- B. During the Guarantee Period, if the Owner allows alteration of the work by anyone other than the General Contractor, including cutting, patching and maintenance in connection with penetrations, and positioning of anything on the roof, this Guarantee shall become null and void upon the date of said alterations. If the owner engages the General Contractor to perform said alterations, the Guarantee shall not become null and void, unless the General Contractor, prior to proceeding with the said work, shall have notified the Owner in writing, showing reasonable cause for claim that said alterations would likely damage or deteriorate the work, thereby reasonably justifying a termination of this Guarantee.
- C. Future building additions will not void this guarantee, except for that portion of the future addition that might affect the work under this contract at the point of connection of the roof areas, and any damage caused by such addition. If this contract is for roofing of an addition to an existing building, then this guarantee covers the work involved at the point of connection with the existing roof.
- D. During the Guarantee period, if the original use of the roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray cooled surface, flooded basin, or other use of service more severe than originally specified, this Guarantee shall become null and void upon the date of said change.
- E. The Owner shall promptly notify the General Contractor of observed, known or suspected leaks, defects or deterioration, and shall afford reasonable opportunity for the General Contractor to inspect the work, and to examine the evidence of such leaks, defects or deterioration.

IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, 20 ____.

General Contractor's Authorized Signature

Typed Name and Title

GENERAL CONDITIONS OF THE CONTRACT

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1. CONTRACT DOCUMENTS:

The Contract consists of the following CONTRACT DOCUMENTS, including all additions, deletions, and modifications incorporated therein before the execution of the Contract Agreement:

- A. STATUTORY AND PROCEDURAL DOCUMENTS:
 - (1) Advertisement for Bids (Invitation for Bids)
 - (2) Instructions to Bidders (Information for Bidders)
 - (3) Proposal (Bid)
 - (4) Proposal Guaranty (Bidder's Bond)
 - (5) Contract Agreement
 - (6) Contract Bonds (Performance and Payment Bonds)
- B. GENERAL CONDITIONS OF THE CONTRACT
- C. DETAILED SPECIFICATION REQUIREMENTS
- D. DRAWINGS
- 2. DEFINITIONS, INTENT, CORRELATION, AND STREAMLINING:
 - A. DEFINITIONS:

Wherever the following abbreviations and terms, or pronouns in place of them, are used in the Contract Documents, the intent and meaning shall be interpreted as follows:

(1) ARCHITECT: The architect, architectural firm, association, or corporation employed by the Owner, or, in case of the termination of his employment, his successor designated by the Owner, to furnish the working drawings and specifications in the Contract Documents, to prepare the Contract Documents, prepare details and explanatory drawings, and provide architectural instructions necessary for the execution of the Work, and to check and approve manufacturers' data and shop drawings and when so provided in his contract, to exercise general administration of the Contract under the direction of the Contracting Officer.

(2) BIDDER: The person, or persons, firm, partnership, association, corporation, or combination thereof, submitting a Bid for the Work, or any portion thereof, acting directly or through a duly authorized representative.

(3) COMMISSION: The Armory Commission of Alabama or any agency that may be designated by the Legislature as its successor.

(4) CONTRACT AGREEMENT: The written Contract Agreement executed between the Owner and the successful Bidder, covering the performance of the Work, by which the Contractor is bound to perform the Work and furnish the labor, materials and equipment under the terms of the Contract Documents, and by which the Owner is obligated to compensate him therefor at the mutually established and accepted rate or price, or as hereinafter provided.

(5) CONTRACT BONDS: The approved bonds furnished by the Contractor and his Surety to guarantee both completion of the Contract in accordance with the Contract Documents and prompt payment to all persons supplying him or them with labor, materials, supplies, etc.

(6) CONTRACTOR: The person or persons, firm, partnership, association or corporation, or combination thereof, that has entered into a Contract with the Owner for any work covered by the Contract Documents, acting directly or through his agents or employees.

(7) CONTRACTING OFFICER: The Contracting Officer of the Armory Commission, acting either upon his own initiative or through duly authorized representatives and inspectors, acting severally within the scope of the particular duties entrusted to them or the authority given them.

(8) MODIFICATIONS OF THE GENERAL CONDITIONS: Changes or modifications of the parts of the Armory Commission's Contract General Conditions.

(9) NOTICE TO PROCEED: A proceed order issued by the Contracting Officer after final execution of the Contract fixing the time within which the Contractor shall begin the prosecution of the Work.

(10) OWNER: The State of Alabama acting by and through the Armory Commission.

(11) BID: The written offer for the Work contemplated, when prepared and submitted by the Bidder in the required manner on the prescribed Bid Form, properly signed and guaranteed.

(12) SPECIAL CONDITIONS: Additional special or general requirements that are necessary and peculiar to the particular project and which are not included in the parts of the Armory Commission's standard General Conditions.

(13) SPECIFICATIONS: The general term comprising the Statutory and Procedural Documents, General Conditions of the Contract, the Detailed Standard and Project Specification requirements, together with all modifications thereof and all Addenda thereto.

(14) SUBCONTRACTOR: Any properly qualified individual, firm, association, or corporation undertaking the performance of any part of the Work under the terms of the Contract Documents by virtue of an agreement between himself and the Contractor with the written approval of the Contracting Officer.

(15) SURETY: The corporate body, licensed under the laws of Alabama, bound with and for the Contractor for the full and complete performance of the Contract and also for the payment of all claims recoverable under the Contract Bonds.

(16) THE PROJECT: The total construction designed by the Architect of which the Work performed under the Contract Documents may be the whole or a part.

(17) THE WORK: The Work includes all labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in such construction.

(18) USPFO: The United States Property & Fiscal Officer. The USPFO is the State of Alabama representative for the National Guard Bureau, Washington, D.C., an agency of the United States Department of Defense.

B. INTENT:

The intent of the Contract Documents is to include all labor, materials, water, fuel, tools, plants, utility, and transportation services, and all other incidental services and expenses necessary or required for proper execution and completion of the work.

C. CORRELATION:

(1) ORDER OF PRECEDENCE: Should any discrepancy arise between the various elements of the Contract Documents, precedence shall be given the same in the following order:

- (a) The Contract Agreement
- (b) The Detailed Specification Requirements
- (c) Details appearing on the Drawings
- (d) The Working Drawings

(2) WORDS AND TERMS: Words used in the documents will be given their usual and common meaning unless from the entire Contract it is clear that some other meaning was intended. Words describing material or work which have a well known technical meaning or trade meaning unless specifically defined in the Contract Documents, will be construed in accordance with such well known meaning recognized by architects, engineers, and the trades. Technical terms will be construed in a technical sense, and a specially widely adopted trade meaning afforded certain terminology will be taken into account in any interpretation containing such terminology.

(3) GENERAL AND SPECIAL CONDITIONS: Where both General and Special Conditions relate to the same thing, the Special will prevail; that is, the specific language will take precedence over the more general wording. However, where both the General and Special Conditions may be given reasonable effect, both are to be retained.

(4) PRINTING, TYPING, AND WRITING: When a printed portion of the Contract Documents cannot be reconciled with a typewritten portion, the latter will prevail. Various types of duplicating processes will be considered typewriting instead of printing. Also, if one is typewritten and the other written in longhand, the one written in longhand will govern. Likewise, written numbers will govern.

Written specifications will take precedence over drawings. If a correction is made in specifications or on a drawing and the original conflicting statement is not crossed out, then the revision, written in or drawn in, will be considered what was meant.

Obvious clerical or drafting errors or omissions revealed by perusal of the Contract Documents as a whole will be discounted in determining the intent of the parties, insofar as this may be accomplished without contravention of legal principles or public policy.

(5) DRAWINGS AND SPECIFICATIONS: The intent of the Specifications is to outline or indicate items of work on both, that cannot readily be shown on the Drawings and, further, to indicate types and qualities of materials and workmanship. Drawings and Specifications will be considered complimentary, and items of work mentioned or indicated on one and not on the other shall be included as if mentioned in both, except items definitely noted "Not in Contract" or marked "N.I.C."

(6) CONTRACTOR'S CHECK: Prior to the execution of the Work, the Contractor shall check the Drawings and Specifications and shall immediately report all errors, discrepancies, and/or omissions discovered therein by letter to the Architect with a copy to the Contracting Officer. All such errors, discrepancies, and/or omissions will be adjusted by the Architect and/or the Contracting Officer, who will notify the Contractor. Any adjustments made by the Contractor without prior approval will be at his own risk and the settlement of any complications arising from such adjustment will be at his own expense.

(7) EXPLANATIONS: Any doubt as to the meaning of the Specifications, or any obscurity as to the wording of them, will be explained by the Architect and all directions and explanations requisite or necessary to complete, explain or make definite any of the provisions of the Specifications and Drawings and given them due effect, will be given by the Architect in writing.

D. STREAMLINING:

(1) OMISSION OF WORDS AND PHRASES: The detailed Standard and Project Specifications are of abbreviated or "streamlined" type and include incomplete sentences in order to avoid cumbersome and confusing repetition of expression. Omissions of words or phrases such as "the Contractor shall," "in conformity therewith," "as noted," or "as indicated on the Drawings, "according to the Drawings," are intentional. Omitted words or phrases will be supplied by inference in the same manner as they are when a "note" occurs on the Drawings.

Wherever in the Specifications or upon the Drawings, APPROVED, AUTHORIZED, CONTEMPLATED, CONSIDERED NECESSARY, DEEMED NECESSARY, DESIGNATED, DIRECTED, GIVEN, ORDERED, PERMITTED, PRESCRIBED, REQUIRED, or words of like import are used, they shall be construed to mean and intend "by the Contracting Officer;" and, similarly, the words ACCEPTABLE, SATISFACTORY, or words of like import shall be construed to mean acceptable to or satisfactory "to the Contracting Officer," unless otherwise expressly stated or the Contract clearly indicates another meaning.

Words "furnish," "install," "perform," "provide," and "work" shall mean that the Contractor shall furnish, install, perform, provide and connect up complete in operative condition and use all materials, equipment, apparatus, and required appurtenances of the particular item to which it has reference.

(2) APPLICABLE PUBLICATIONS: Reference to standard specifications, associations, bureaus, organizations, or industries, and the like, shall mean the latest edition of such references adopted and published at date of Advertisement for Bids.

3. ADDITIONAL DETAIL DRAWINGS AND INSTRUCTIONS:

Further information and instructions may be issued by the Contracting Officer or prepared by the Architect and transmitted to the Contractor by the Contracting Officer or the Architect, during the progress of the Work by means of additional detail drawings or otherwise as deemed necessary to make more clear or specific the Drawings and Specifications in the Contract Documents, when and as required by the Work. All such drawings and instructions shall be consistent with the Contract Documents, true developments thereof, and reasonably inferable therefrom.

Any discrepancies found between the Drawings and Specifications and site conditions shall be immediately reported in writing to the Architect who will promptly correct such error or omission in writing. Any work done by the Contractor after his discovery of such discrepancies, errors, or omissions shall be done at his own risk.

In case of differences between small and large scale drawings, the large scale drawings shall govern.

Where on any of the drawings a portion of the Work is drawn out and the remainder is indicated in outline, the parts drawn out shall apply also to all other portions of the Work.

Where the word "similar" occurs on the Drawings, it shall be interpreted in its general sense and not as meaning identical, and all details shall be worked out in relation to their location and their connection with other parts of the Work.

If the Contractor considers that any work is required in a manner to make it impossible to produce firstclass work, or should discrepancies appear among the Contract Documents, the Contractor shall request interpretation before proceeding with such work. If he fails to make such request, no excuse will thereafter be entertained for failure to carry out the work in a satisfactory manner.

4. COPIES FURNISHED CONTRACTOR:

Except as otherwise provided, all required copies of Drawings and Specifications reasonably necessary for the execution of the Work will be furnished to the Contractor by the Architect or Contracting Officer without charge. Other copies requested will be furnished at reproduction cost.

5. SHOP DRAWINGS:

The Contractor shall check the Contract Drawings for accuracy and verify with field measurements as necessary. He shall submit to the Architect, with his criticism and/or approval, all layouts, detail schedules, shop drawings, and setting or erection drawings as required by the Specifications or requested by the Contracting Officer for proper installation of materials, without causing delay in the Work. The Contractor shall check Subcontractors' shop drawings for accuracy and see that work contiguous with and having bearing on work indicated on shop drawings is accurately and distinctly illustrated. Shop drawings shall be dated, numbered consecutively, show working and erection dimensions and necessary details, including complete information for connecting to other work. Any work required by shop drawings that is fabricated by the Contractor prior to approval shall be at his own risk.

All drawings and schedules, accompanied by a letter of transmittal containing project number, number of drawings, titles, or other pertinent data, shall be submitted to the Architect in quintuplicate by the Contractor (with his stamp of approval thereon) sufficiently in advance of construction requirements to allow checking, correcting, resubmitting, and rechecking. A duplicate of said letter, only, shall be mailed simultaneously to the Contracting Officer. If shop drawings show variations from the requirements of the Contract Documents because of standard shop practice or other reasons, specific mention of such variations shall be made in the letter of submittal.

Satisfactory drawings will be so identified, dated, approved, and three copies or sets returned to the Contractor by the Architect. Should shop drawings be disapproved, three sets will be returned to the Contractor by the Architect indicating corrections and changes to be made.

Such corrections, changes, including design and artistic effect, shall be made by the Contractor and bound sets of shop drawing prints shall be submitted in quintuplicate to the Architect until final approval is obtained. No corrections or changes indicated on shop drawings will be considered as Extra Work.

The approval of shop drawings, schedules, and setting drawings will be general and, except in departures found to be in the interest of the Owner and so minor as not to involve a change in the Contract Price or performance time, shall not be construed (1) as permitting any departure from contract requirements; (2) as relieving the Contractor of the responsibility for any error in details, dimensions, or otherwise that may exist in shop drawings or schedules; (3) as approving departures from Drawings and Specifications or from additional details or instructions previously furnished by the Architect, unless he has in writing called attention to such deviations at the time of submission, and secured written approval.

6. PROJECT AND RECORD DOCUMENTS:

The Contractor shall keep on the site of the work in good order, at least one set of his Contract Drawings including shop drawings, Specifications, and all authorized Change Orders, and shall at all times give the Owner, Architect, and their authorized representatives access thereto.

The Contractor shall also keep in his office on the site of the work the two sets of Contract Drawings and Specifications furnished by the Owner, herein referred to as RECORD DRAWINGS, on which shall be recorded all work as built or installed, and such other information as is specified or required. He shall carefully draw and letter notes of explanation, in ink, on both sets of Record Drawings, or furnish two copies of detailed sketches as the Contracting Officer may require, as a fully dimensioned record of all work. The Record Drawings, supplemented by any detailed sketches deemed necessary, shall indicate the Work "AS BUILT". The Contractor will be required to prepare new drawings if the indications on the Record Drawings or the detailed sketches are illegible or otherwise unsatisfactory for future reference. Each record or correction made on such drawings will be initialed and dated by the Supervisor or Inspector.

7. OWNERSHIP OF DRAWINGS:

All original or duplicated Drawings and Specifications, and other data prepared by the Architect, and copies thereof prepared and furnished to the Contractor by the Architect are the property of the Armory Commission.

Upon completion of the Work all copies of Drawings and Specifications, with the exception of two sets retained by the Contractor, and two sets of RECORD DRAWINGS, shall be returned by the Contractor to the Architect. The Record Drawings will be delivered by the Architect to the Owner on Completion of the Work.

8. SAMPLES:

The Contractor shall, without undue delay, furnish and submit to the Architect any samples that require the Architect's approval, and also any samples that may be requested by the Contracting Officer, of any and all materials or equipment he proposes to use, and shall prepay all shipping charges on the samples. Samples shall be furnished sufficiently in advance to allow the Architect and/or Contracting Officer reasonable time for examination, investigation, or consideration, without delay to the Work.

The Contractor shall provide Subcontractors and his prospective manufacturers, material dealers or suppliers with complete information of pertinent contract requirements and all transactions therewith shall be through the Contractor.

No materials or equipment of which samples are required to be submitted for approval shall be used on the Work until such approval has been received, save only at the Contractor's risk and expense.

Each sample shall have a label indicating the material represented, its place of origin and the name of the producers, the Contractor, and the building or Work for which the material is intended. Where manufacturer's printed instructions for installations are required, duplicate copies of such directions shall be submitted with samples.

Samples of finished material shall be marked to indicate where the materials represented are required by the Drawings or Specifications.

A letter, submitting each shipment of samples shall be mailed by the Contractor to the Architect containing a list of the samples, the name of the building or Work for which the materials are intended, and the brands of materials and names of the manufacturers.

After a material has been approved by the Architect with the approval of the Contracting Officer, if required, no additional samples of that material will be considered and no change in brand or make will be permitted.

Approved samples of hardware, in good condition, may be suitably marked for identification and used in the Work.

The approval of any sample by the Architect or Contracting Officer will be only for the characteristics or for the uses named in such approval and shall not be construed in itself to change or modify any Contract requirements.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider any further samples of the same brand or make of that material for use in the Work.

Test samples as the Architect or Contracting Officer may deem necessary, will be produced from the various materials delivered to the Contractor for use in the Work. If any of these test samples fail to meet the specification requirements, any previous approval will be withdrawn and such materials shall be subject to removal and replacement by the Contractor with materials or equipment meeting the specification requirements, the defective materials may be permitted to remain in place subject to proper credit or adjustment of the Contract Price as hereinafter set forth under DEDUCTIONS FOR UNCORRECTED WORK.

The costs of tests will be borne by the Owner except where laboratory tests as hereinafter specified are required by the specifications.

9. PROGRESS SCHEDULE AND CHARTS:

The Contractor shall within five days after date of commencement of work, prepare and submit to the Architect for approval, a practicable schedule showing the order in which the Contractor proposes to carry on the Work, the date he will start the several salient features, including procurement of material, plant, and equipment and the contemplated date of completion of same.

The schedule shall be in the form of a conventional Progress Chart of suitable scale to indicate appropriately the percentage of work scheduled for completion at any time. The Contractor shall enter on the chart his actual progress, preferably at the end of each week, but in any event at the end of each month, and deliver to the Architect two copies thereof and attach one to his monthly Application for Partial Payment.

If, in the opinion of the Architect or the Contracting Officer, the Contractor falls materially behind his progress schedule, the Contractor shall take such steps as may be necessary to improve his progress and the Architect or the Contracting Officer may require him to increase the number of shifts, and/or overtime operations, and/or the amount of construction plant, and to submit for approval such supplementary schedules in chart form as may be deemed necessary to demonstrate the manner in which the agreed rate of progress will be regained, all without additional cost to the Owner.

Failure of the Contractor to comply with the requirements of the Architect or the Contracting Officer as above set forth will be grounds for determination by the Architect or the Contracting Officer that the Contractor is not prosecuting the Work with such diligence as will insure completion within the Contract Time. Upon determination of unreasonable delay, the Owner may terminate the Contractor's right to proceed with the Work, or any separable part thereof.

10. MATERIALS, EQUIPMENT, AND EMPLOYEES:

Unless otherwise stipulated, the Contractor shall furnish all material, equipment, tools, labor, water, light, power, transportation, other services or facilities and incidentals for the proper execution and completion of the Work. Unless otherwise stipulated, all materials and equipment incorporated in the Work shall be new.

All labor shall be performed in the best and most workmanlike manner by persons skilled in their respective assignments or trades. Workmen whose work is unsatisfactory to the Architect or the Contracting Officer, or who are considered unfit or unskilled, or otherwise objectionable, shall be dismissed upon notice from the Architect or Contracting Officer.

11. EQUIPMENT AND MATERIAL DEVIATIONS:

Whenever any material or piece of equipment is identified on the plans or in the specifications by reference to manufacturer's names, model numbers, etc., it is intended to establish a required standard of design and quality, and is not intended to limit competition. It shall be expressly understood that the phrase "or approved equal" is hereby inserted following the naming of manufacturers for any material or equipment, whether such phrase occurs in the specifications, or not.

When the specifications and/or drawings indicate only one or two manufacturers' names for material or equipment to be used, the bidder may submit his bid based on material or equipment of manufacturers not named but considered by the bidder to be equal to the standard of design and quality as specified; however, such substitutions must be approved by the Architect. If the bidder elects to bid on a substitution without securing written approval of the Architect prior to receipt of bids, then it will be understood that proof of compliance with specified requirements is the direct responsibility of the bidder and no such material or equipment may be purchased or installed without written approval by the Architect.

When the specifications and/or drawings indicate three or more manufacturers' names for material or equipment to be used, the bids shall be based upon the equipment and material so named, unless the bidder desires to bid on an "approved equal". In case the bidder desires to substitute an "equal" he must secure written approval by the Architect of qualification to bid prior to date for receiving bids. If no request to substitute an "approved equal" is made by the bidder, and approved by the Architect, then it will be expressly understood that all such material and equipment so named or described in the specifications and on the drawings will be furnished in full accordance with the Contract Documents.

12. ROYALTIES; PATENTS; AND COPYRIGHTS:

The Contractor shall pay all royalties and license fees. The Contractor shall hold and save the Owner and his agents and employees harmless from liability of any nature or kind, including cost and expenses, for or on account of any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the Contract, including its use by the Owner.

If the Contractor has information that any process, article or item specified or delineated by the Architect is an infringement of a patent, or a copyright, he shall promptly give such information to the Architect.

13. SURVEYS, PERMITS, LAWS, AND REGULATIONS:

The Contractor shall provide competent engineering services to execute the Work in accordance with contract requirements. He shall verify the figures given for the contours, approaches and locations shown on the Drawings before undertaking any construction work and be responsible for the accuracy of the finished work. Without extra cost to Owner, he shall engage a licensed surveyor if necessary to verify boundary lines, keep within property lines, and shall be responsible for encroachments on rights or property of public or surrounding property Owners.

The Contractor shall establish all base lines for the location of the principal components of the Work and make all detail surveys necessary for construction, including slope stakes, batter boards and other working points, lines and elevations.

If the Contractor finds any errors or discrepancies, or that any previously established references have been destroyed or misplaced, he shall promptly notify the Architect.

The Contractor shall obtain and pay for all licenses and permits and shall pay all fees and charges for connection to outside service and the use of property, other than the site of the Work, required for the execution and completion of the Work.

The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations, and building code requirements applicable to or bearing on the conduct of the Work unless in conflict with Contract requirements. If the Contractor ascertains at any time that any requirement of the Contract is at variance with applicable laws, ordinances, regulations, or building code requirements, he shall promptly notify the Architect, and any necessary adjustment of the Contract will be made as hereinafter specified under CHANGES IN THE WORK.

The Contractor shall pay all applicable Federal, State and local taxes and assessments on the real property of the site of the Work.

Wherever the law of the place of building requires a special sales tax, consumer, use, occupation, or other tax, the Contractor shall pay such tax.

14. PROTECTION OF WORK AND PROPERTY:

The Contractor shall at all times adequately maintain, guard and protect his own work from damage, and safely guard and protect the Owner's property from injury or loss arising in connection with this Contract. He shall make good any such damage, injury or loss, except such as may be directly due to errors in the Contract Documents or caused by agents or employees of the Owner.

He shall adequately protect adjacent property as provided by law and Contract Documents.

Any damage to existing structures, or the interruption of a utility service shall be repaired or restored promptly by and at the expense of the Contractor.

The Contractor shall protect all existing vegetation such as trees, shrubs, and grass on or adjacent to the site which are not required to be removed or do not unreasonable interfere with construction, as may be determined by the Architect or Contracting Officer, and be responsible for all unauthorized cutting or damaging of trees and shrubs, including damage due to careless operation of equipment, stockpiling of materials, on grass areas by equipment.

Care shall be taken by the Contractor in felling trees that are to be removed to avoid any unnecessary damage to vegetation or other trees that are to remain in place. Any limbs or branches unavoidably broken during such operations shall be trimmed with a clean cut and painted with an approved tree priming compound. The Contractor may be required to replace or restore at his own expense all vegetation not protected and preserved, as above required, that may be destroyed or damaged.

The Contractor shall provide and maintain all passageways, guard fences, lights, and other facilities required for protection by state or municipal laws and regulations or local conditions.

The Contractor shall take all necessary precautions for the safety of employees on the Work and shall comply with all applicable provisions of federal, state, and municipal safety laws and building codes to prevent accidents or injury to persons on or about or adjacent to the premises where the Work is being performed. He shall erect and properly maintain at all times, as required by conditions and progress of the Work, all necessary safeguards for the protection of workmen and the public, and shall post danger signs warning against the hazards created by such features of construction as protruding nails, hoists, well holes, elevator hatchways, scaffolding, window openings, stairways, and falling materials.

Machinery, equipment and all hazards shall be guarded or eliminated in accordance with the latest edition of the Manual of Accident Prevention in Construction of the AGC to the extent that such provisions are not in contravention of applicable laws.

In case of an emergency which threatens loss or injury of property, and/or safety of life, the Contractor may act, without previous or special instructions from the Architect, or the Contracting Officer, at his discretion; and shall so act, without appeal, if so instructed or authorized by the Architect or the Contracting Officer.

Any compensation claimed by the Contractor as Extra Work on account of emergency work, together with substantiating documents in regard to expense, shall be submitted through the Architect to the Contracting Officer who will determine the amount of compensation.

15. CLIMATIC CONDITIONS:

When so ordered by the Architect or Contracting Officer, the Contractor shall suspend any work that may be subject to damage by climatic conditions.

16. TEMPORARY UTILITIES:

Unless otherwise agreed to by the Owner in writing, the Contractor shall provide all necessary utility services, at his expense, until the job is complete and accepted by the Owner. All utilities services shall include, but not be limited to, the following: electricity; gas; water; sewer; telecommunications; waste (dumpster) disposal, etc.

The Contractor shall provide all utility services as necessary to install and/or test all work and materials, and further to protect and maintain all work and materials against injury or damage from heat or cold and from humidity/dampness. The Contractor shall continue to provide these services, at his expense, until completion and final acceptance by the Owner of all work in the Contract. The Contractor may be relieved of utilities expenses, in whole or part, should the building(s) be fully occupied by the Owner prior to such final acceptance of the work. The Contractor may petition in writing for the Owner to consider this relief of utilities expenses (either partially or wholly) due to this full occupation of the building(s) by the Owner. The Owner must provide a written and signed agreement in order to relieve Contractor of the utilities expenses. Any such date of relief shall be as established in this written agreement.

In the absence of any such written agreement by the Owner, the Contractor shall continue to provide heat and conditioned air as necessary to protect all work and materials against injury from dampness and heat/cold until final acceptance of all work in the Contract as indicated herein.

A. HEATING: During cold weather or the winter months, the Contractor shall provide heat and weather protection as follows:

(1) At all times during the placing, setting, and curing period of concrete, sufficient heat to insure the heating of spaces to not less than 50° F. or in accordance with the manufacturer's recommendations.

(2) From the beginning of the application of plaster and during the setting and curing period, sufficient heat to produce a temperature of not less than 50° F. or in accordance with the manufacturer's recommendations.

(3) For a period of ten days previous to the placing of interior wood finish work and throughout the placing of wood finish and other interior finishing, varnishing, painting, etc., and until final acceptance of the Work, sufficient heat to produce a temperature of not less than 70° F. or in accordance with the manufacturer's recommendations.

(4) Provide temporary closures for windows, doors, and all temporary openings and take every reasonable precaution to prevent the escape of warm air from or entrance of cold air into the building. Except as elsewhere called for, the temperature required in the unoccupied spaces will be from 45° F. to 65° F.

B. VENTILATION and AIR CONDITIONING: During hot weather or the summer months, the Contractor shall provide ventilation and/or air conditioning as required in order to maintain the temperature of the interior of the building(s) between 70° F. and 80° F. The Contractor shall also maintain the humidity level of the interior of the building(s) within the ranges specified in the Contract Documents.

C. In all cases, Contractor shall be responsible to maintain the appropriate temperature range and humidity levels as is recommended by the manufacturer of all the various building materials, furnishings, equipment, components, systems, etc. to prevent any damage due to heat or cold or humidity.

D. Unless otherwise agreed to by the Owner in writing, the Contractor shall continue to provide these utility services, at his expense, until the job is complete and accepted by the Owner.

17. INSPECTION OF THE WORK:

The Architect, the Contracting Officer, any Federal or State agency having jurisdiction, and their representatives shall have access at all times to the Work for inspection whenever it is in preparation or progress, and the Contractor shall provide proper facilities for such access and inspection.

All materials, workmanship, processes of manufacture, and methods of construction, if not otherwise stipulated in the Specifications, shall be subject to inspection, examination, and test by the Architect (or his

duly authorized representative) at any and all places where such manufacture and/or construction are being carried on. The Architect shall have the right to reject defective material and workmanship or require its correction. Rejected workmanship shall be satisfactorily corrected, and rejected material shall be satisfactorily replaced with proper material without charge therefor, and the Contractor shall promptly segregate and remove the rejected material from the premises.

The Contracting Officer will appoint or assign architectural and engineering Inspectors, with designated duties and restricted authority, to inspect the Work as he may direct, or to make special inspections requested in advance by the Contractor, and to report to him progress of the Work, and manner of procedure, quality of the material and workmanship, and compliance with the Contract Documents. Inspectors shall have the authority to give directions for the safety and convenience of the public, and concerning the conduct of the Work; to advise the Contractor to avoid his making errors and to expedite his correction of deviations in the Work, to reject materials, workmanship, or equipment clearly defective or otherwise not in accordance with the Drawings and Specifications; but neither the presence nor absence of such Inspectors shall relieve the Contractor from any contract requirement.

Neither the Inspectors, nor the Architect, will be authorized to revoke, alter, relax, or waive, any requirements of the Contract Documents, to finally approve or accept any portion of the Work or to issue instructions contrary to the Drawings and Specifications; nor shall they supervise and direct work for the Contractor, nor unreasonably interfere with the Contractor's operations beyond the extent necessary to make certain that the Work is being carried out according to the contract requirements.

Any advice which they may give the Contractor shall not be construed as binding the Owner or the Contracting Officer in any way, nor as releasing the Contractor from any of the contract requirements.

If the Contractor considers any work demanded of him to be outside the contract requirements, or any record or ruling of the Architect or an Inspector to be unfair, he may immediately, upon such work being demanded or ruling made, request written instructions from the Architect, or Inspector, or within ten days file an appeal with the Contracting Officer, stating clearly and in detail the basis of his objections. However, pending the Contracting Officer's decision on such appeal, no work shall be done in disregard of the rulings of the Architect or Inspector or his instructions on items of work affected by such appeal.

The Contractor shall furnish promptly, without extra compensation, all reasonable facilities, labor, and material necessary for safe and convenient access, inspection, and tests that may be required by the Contracting Officer or the USPFO. All inspections and tests will be performed in such a manner as not to cause unnecessary delay of the work. Special, full size, and performance tests shall be as described in Sections of the Specifications. The Contractor shall be charged any extra cost of inspection incurred by the Owner on account of material and workmanship not being ready at time of inspection set by the Contractor.

Should it be considered necessary or advisable by the Owner, or by the representatives of the Chief, National Guard Bureau, at any time before final acceptance of the entire work to make an examination of work already completed by uncovering, or removing or tearing out same, the Contractor shall, on request, promptly furnish all necessary facilities, labor, and materials. If such work is found to be defective in any material respect, due to the fault of the Contractor or his subcontractors, he shall defray all expense of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract Documents, work of examination and replacement will be considered and compensated for as Extra Work ordered by the Architect or Contracting Officer and, in addition, if completion of the Work has been delayed thereby, an extension of time will be granted for such delay as estimated by the Architect or Contracting Officer. Federal funding support of the cost for examination and replacement of satisfactorily completed work that requires removal or that is damaged due to inspection requirements is subject to prior approval by the Chief, National Guard Bureau, or his duly authorized representative.

When the Architect considers the work as nearing completion, or substantially completed, after being notified by the Contractor that the Work is completed, the Architect and the Contracting Officer or his representatives, duly authorized in writing, will inspect all the work included in the Contract Documents. If it is found that the Work has not been satisfactorily completed, the Architect will notify the Contractor, in writing, as to the work to be done or the particular defects to be remedied to place the work in condition satisfactory for acceptance. After the work has been satisfactorily completed, the Architect and the Contracting Officer will make the final inspection or inspections and notify the Contractor in writing when the Work has been finally accepted.

18. SUPERINTENDENCE AND SUPERVISION:

The Contractor shall give his personal superintendence of the Work, using his best skill and personal attention, or have a qualified superintendent, and any necessary assistants acceptable to the Contracting Officer, on the Work at all times during progress, and with full authority to act in his behalf. The Contractor shall not remove a superintendent from the Work who is satisfactory to both him and the Architect, except with the Architect's consent, unless he ceases to be in his employ.

All instructions given the superintendent in the Contractor's absence by the Architect or the Contracting Officer or his representative shall be considered as given the Contractor. In general, the more important verbal instructions will be confirmed in writing to the Contractor; and upon written request of the Contractor, any other instructions will be confirmed in writing.

The Contractor shall carefully study and compare all Drawings, Specifications, other instructions and related data, and at once report in writing to the Architect, with a copy to the Owner, any inconsistency, discrepancy, error, or omission he may discover, for adjustment by the Architect. However, he shall not be liable to the Owner for any damage resulting from any errors or deficiencies in the Contract Documents, except that adjustments made without prior approval will be at his own risk.

19. CHANGES IN THE WORK:

The Owner may at any time make changes in the Work by changes in the Drawings and Specifications of the Contract and within the general scope thereof. Changes will be in the form of a Contract Change Order based upon a written request of the Owner and a written proposal of the Contractor. In making any change, the charge or credit for altering, adding to or deducting from the Work shall be determined by one of the following methods selected by the Owner:

A. By mutually agreed price or prices which will be added to or deducted from the Contract Price. Additions to the contract price shall include the Contractor's overhead and profit but shall not exceed 15 percent. Where subcontract work is involved, the total mark-up for the Contractor and subcontractors shall not exceed 25%. This percentage allowance for overhead and profit shall include the cost of superintendent, timekeeper, clerks, watchmen, use of small tools, incidental job burdens, and general office expenses. There will be no additional or separate charges for these items. No allowance for overhead and profit shall be figured on any change which involves a net credit to the Owner.

B. By estimating the number of unit quantities of each part of the Work which is changed and then multiplying the estimated number of such unit quantities by the applicable unit prices, if any, set forth in the Contract, or other mutually agreed unit prices. The percentage and criteria for overhead and profit shall be as detailed in paragraph A above. There will be no additional or separate charges allowed for superintendent, timekeeper, clerks, watchmen, use of small tools, incidental job burdens, and general office expenses.

C. By ordering the Contractor to proceed with the Work on a cost-plus-percentage-of-the-cost basis and to keep and present in such form as the Contracting Officer will approve, duplicate itemized statements of the cost of the change together with all vouchers therefor, detailed as to the following items:

(1) Name, classification, date, daily hours, total hours, rate, and extensions for such laborers and pro-rata charges for foreman.

(2) Designation, dates, daily hours, total hours, rental rates, and extensions for each piece of equipment or power tool actually used.

(3) Quantity of each material item actually used and extension.

(4) Transportation on materials used.

(5) Power and all items of cost such as cost of property damage, public liability and workmen's compensation insurance; also social security, old age and unemployment insurance.

(6) The percentage allowance for the Contractor's overhead and profit shall not exceed a total of 15 percent of the net cost of above items (1), (2), (3), (4) and (5). The percentage allowance for overhead

shall include the cost of bonds, superintendent, timekeeper, clerks, watchmen, use of small tools, incidental job burdens, general office expenses, and insurance other than items listed above in paragraph C(5).

(7) The credits to the Owner for deductive changes shall be the net cost to the Contractor, excluding project overhead and profit.

The Contractor shall furnish to the Owner an itemized breakdown of the quantities and prices to be used in estimating the value of any change that might be ordered.

Federal funding support of any change or extra is subject to prior approval by the Chief, National Guard Bureau, or his/her duly authorized representative.

20. CLAIMS FOR EXTRA COST OR EXTRA WORK:

If the Contractor claims that any instructions, by drawings or otherwise, are not in accordance with the Contract Documents, and involve extra cost under the Contract, he shall give the Architect and the Contracting Officer written notice there of within ten (10) days after receipt of such instructions, and in any event before proceeding to execute the work, and the procedure shall then be as above under 19, CHANGES IN THE WORK. Otherwise no such claim will be considered.

Federal funding support of any change or extra is subject to prior approval by the Chief, National Guard Bureau, or his/her duly authorized representative.

21. DEDUCTIONS FOR UNCORRECTED WORK:

If the Owner deems it expedient to correct work injured or installed at variance with the Contract requirements, the Owner may, if he finds it to be in his interest, allow part or all of such work to remain in place, provided an equitable deduction from the Contract Price is offered by the Contractor and approved by the Contracting Officer.

22. DELAYS; EXTENSION OF TIME:

Delays: A delay beyond the Contractor's control at any time in the progress of Work by an act or omission of the Owner or the Architect, or the Contracting Officer or by any other Contractor employed by the Owner, or by strikes, fires, abnormal floods, tornadoes, or other cataclysmic phenomenon of nature, may entitle the Contractor to an extension of time in which to complete the Work as determined by the Contracting Officer provided, however, that the Contractor shall immediately give written notice to the Architect of the cause of such delay.

No such extension shall be made for delays due to rain, wind, flood, or other natural phenomenon of normal intensity for the locality, or for delay occurring more than seven (7) days before written claim therefor is submitted by the Contractor.

Extension of Time: In the event any material changes, alterations or additions are made as herein specified which in the opinion of the Contracting Officer, will require additional time for the execution of any work under the Contract, then, in that case, the time of completion of the Work will be extended by such a period of time as may be fixed by the Contracting Officer, and his decision shall be final and binding upon the Owner and the Contractor, provided that in such case the Contractor within seven (7) days after being notified in writing of such changes, alterations or additions shall request in writing an extension of time, but no extensions of time shall be given for any minor changes, alterations or additional time or extensions of time required for the execution of the Work. Only claims for compensation that are approved in accordance with the procedures outlined as above in Paragraph 19, CHANGES IN THE WORK and in Paragraph 20, CLAIMS FOR EXTRA COST OR EXTRA WORK and are also approved in writing by the Owner shall be considered.

23. CORRECTION OF WORK BEFORE FINAL PAYMENT:

Any defective work, whether the result of poor workmanship, the use of defective materials, damage through carelessness of the Contractor or his employees, or any other cause, shall be removed from the premises within ten (10) days after written notice is given by the Architect, and promptly replaced and re-

executed by the Contractor in accordance with the contract requirements and without expense to the Owner. The Contractor shall also bear the expense of making good all work of the Owner or his other contractors destroyed or damaged by such removal and replacement.

24. CORRECTION OF WORK AFTER FINAL PAYMENT:

Verification and approval of the Final Application for Payment and the making of the Final Payment by the Owner shall not relieve the Contractor of responsibility for faulty materials or workmanship. The Owner or the User shall promptly give notice of observed defects due to faulty materials or workmanship, and any damage to other work resulting therefrom, and in accordance with the terms of any special guarantees provided by the Contract, and the Contractor shall promptly replace any such defects discovered within one year from the date of written acceptance of the Work or Final Payment therefor, whichever is prior. All questions arising hereunder, notwithstanding Final Payment, shall be decided by the Contracting Officer.

25. OWNER'S RIGHT TO CORRECT DEFICIENCIES:

Upon failure or neglect by the Contractor to properly prosecute, or to perform the Work in accordance with the Contract Documents, including any requirements with respect to the Progress Schedule and/or Charts, and after ten (10) days' written notice to the Contractor by the Contracting Officer, the Owner may, without prejudice to any other remedy he may have, correct such deficiencies and may deduct the actual cost thereof to the Owner from payment then or thereafter due to the Contractor, provided, however, that the Contracting Officer shall approve both such action and the amount charged the Contractor.

26. OWNER'S RIGHT TO TERMINATE CONTRACT:

If the contractor refuses or fails to prosecute the work, or any separate part thereof, with such diligence as will insure its completion within the time specified in this contract, or any extension thereof, or fails to complete said work within such time, or if the Contractor should be adjudged a bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he should refuse or should fail, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials, or if he should fail to make prompt payment to Subcontractors for material or labor, or disregard laws, ordinances, or the instructions of the Contracting Officer or the Architect, or otherwise be guilty of a substantial violation of any provision of the Contract, then the Owner, upon the certificate of the Contracting Officer that sufficient cause exists to justify such action, may, without prejudice to any other right or remedy and after giving the Contractor, and his Surety, ten (10) days' written notice, terminate the employment of the Contractor and take possession of the promises and of all materials, tools, equipment, and appliances thereon and finish the Work by whatever method he may deem expedient. In such cases, the Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price shall exceed the expense of finishing the work, including compensation for additional architectural, engineering, managerial, and administrative services, such excess shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the Contractor shall pay the difference to the Owner. The expense incurred by the Owner as herein provided, and the damage incurred though the Contractor's default, shall be certified by the Contracting Officer.

27. CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE THE CONTRACT:

If the Work should be stopped under an order of any court, or other public authority, for a period of ninety (90) days, through no act or fault of the Contractor or of anyone employed by him, then the Contractor may, upon fourteen (14) days' written notice to the Owner and the Contracting Officer, stop work or terminate this Contract at the Owner(s) will reimburse the Contractor for all work properly executed and any proven loss sustained upon any plant or materials and any other proper item of damage certified by the Contracting Officer.

28. APPLICATIONS FOR PARTIAL AND FINAL PAYMENTS:

The Contractor shall, within ten (10) days after the Notice to Proceed, submit to the Architect on the application for payment form approved or furnished by the Contracting Officer, a complete breakdown or schedule of values of the Contract price showing the value assigned to each of the various parts of the work, including an allowance for overhead and profit, aggregating the total contract price so divided as to facilitate payments to subcontractors. Upon approval, this breakdown of the contract price, unless later found to be in error, shall be used as a basis for all applications for payment.

Unless otherwise provided in the Special Conditions or the Contract Agreement, the Contractor may make application for partial payment once each calendar month based on an approved estimate of work completed. The application shall be submitted through and certified by the Architect. The Owner will make partial payments to the Contractor as soon as practicable after receipt of the certified application for payment.

An application for partial payment may include the Contractor's cost of materials not yet incorporated in the work but delivered and suitably stored on the site.

In making partial payments there shall be retained not more than five (5) percent of the estimated amount of work done and the value of materials stored on the site, and after 50 percent completion has been accomplished, no further retainage will be withheld. The retainage above set out shall be held until final completion and acceptance of all work covered by the contract.

If the Contractor's claim to amounts payable under the contract has been assigned under the Assignment of Claims Act of 1940, as amended (41 U.S.C. 15), a release may also be required of the assignee at the option of the Contracting Officer or USPFO of the State. The retainment on partial payments of Federal funds shall be determined by the USPFO of the State in conformance with the Defense Acquisition Regulations (DAR).

The Contractor, immediately after being notified by the Contracting Officer that all other requirements of the Contract have been completed, shall give notice of said completion by an advertisement for a period of four (4) successive weeks in some newspaper of general circulation published within the county where the work was performed. Proof of publication of said notice in duplicate shall be furnished by the Contractor to the Architect by affidavit of the publisher and a printed copy of the notice published in duplicate. If no newspaper is published in the county where the work was done, the notice may be given by posting at the Court House for thirty (30) days and proof of same made by the Probate Judge or Sheriff and the Contractor. Final payment shall be due as noted by the Contracting Officer's verification of the Final Application for Payment.

29. VERIFICATION, CERTIFICATION, AND APPROVALS FOR PAYMENT:

When the Contractor has made application for payment as above, the Contracting Officer shall, not later than the date when each payment falls due, verify the application for Payment to the Contractor for such amount as he decides to be properly due, or state in writing to the Contractor his reasons for withholding verification in whole or in part, and place the application in line for payment.

No such verification nor payment made to the Contractor, nor partial or entire use or occupancy of the work by the Owner, shall be an acceptance of any work or materials not in accordance with the Contract.

All material and work covered by partial payments made shall thereupon become the sole property of the Owner, but this provision shall not be construed as relieving the Contractor from the sole responsibility for the care and protection of material and work upon which payments have been made or the restoration of any damaged work or as a waiver of the right of the Owner to require the fulfillment of all the terms of the Contract.

30. PAYMENTS WITHHELD:

The Owner may withhold payment of the whole or any part of a verified or approved Application for Payment to such an extent as may be necessary to protect himself from loss on account of any of the following causes discovered subsequent to its verification or approvals:

A. Defective work.

B. Evidence indicating probable filing of claims by other parties against the Contractor.

C. Failure of the Contractor to promptly make payments to subcontractors, or for materials, labor, equipment and supplies.

D. Damage to another contractor under a separate Contract with the Owner.

When the above grounds are removed, applications for payments will then be verified and/or approved for amounts not previously verified and approved because of them.

31. CONTRACTOR AND SUBCONTRACTORS INSURANCE:

The Contractor shall not commence work under the Contract until he has obtained all insurance required thereunder from an insurance company authorized to do business in Alabama, and shall have filed the certificate of insurance showing type of coverage and correlation between the insurance furnished and that required or the certified copy of the insurance policy with the Contracting Officer through the Architect; nor shall the Contractor allow any subcontractor to commence work on his subcontract until all similar insurance has been so obtained and filed. Each insurance policy shall contain a clause that it shall not be cancelled by the insurance company without thirty (30) days' written notice to the Owner of intention to cancel. The amounts of such insurance shall not be less than the following:

Α.	Workmen's Compensation and Employer's Liability:	\$ Statutory
В.	Public Liability, Bodily Injury and Property Damage:	
	Injury or death of one person:	\$ 50,000
	Injury or death to more than one	
	person in a single occurrence:	\$200,000
	Property Damage:	\$ 50,000
C.	Automobile and Truck Liability, Bodily Injury and Property Damage:	
	Injury or death to one person:	\$ 50,000
	Injury or death to more than one	
	person in a single occurrence:	\$200,000
	Property Damage:	\$ 50,000
D.	Indemnity:	SEE BELOW

The Contractor shall assume all liability for and shall indemnify and save harmless, the State, Owners, Architect, and employees of the Armory Commission, from all damages and liability for injury to any person or persons, and injury to or destruction of property, including the loss of use thereof, by reason of an accident or occurrence arising from operations under the Contract, whether such operations be by himself or by a Subcontractor or by any one directly or indirectly employed by either of them, occurring on or about the premises, or the ways and means immediately adjacent, during the term of the contract, or any extension thereof, and shall also assume the liability for injury and/or damages to adjacent or neighboring property by reason of work done under the Contract.

The Contractor shall take out and maintain during the life of the Contract, insurance covering his liability under the above save harmless provision, and shall show evidence of coverage on the certificate of coverage previously noted.

The obligations of the Contractor under this paragraph 31-D shall not extend to the liability of the Architect, his agents or employees arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications, or (2) the giving of or the failure to give directions or instructions by the Architect, his agents or employees provided such giving or failure to give is the primary cause of the injury or damage.

32. OWNER'S FIRE INSURANCE (NOT USED)

33. FIRE INSURANCE, EXTENDED COVERAGE, VANDALISM AND MALICIOUS MISCHIEF:

Unless otherwise provided in the Modified General or Special Conditions, the Contractor shall, at his own expense, insure the Work included in the Contract against loss or damage by fire and against loss or damage covered by the standard extended coverage endorsement, with an insurance company or companies qualified to do business in Alabama and acceptable to the Owner, the amount of insurance at all times to be at least equal to the amount paid on account of work or materials incorporated in the Work and plus the value of work or materials furnished or delivered but not yet paid for by the Owner. The policies shall be in the names

of the Owners and the Contractor and "all Subcontractors" as their interests appear, and certificates of the insurance company as to the amount and type of coverage, terms of policies, etc., shall be delivered to the Contracting Officer through the Architect before partial payments are made.

When changes in scope of the work by written Change Order or Change Orders/Supplemental Agreements aggregate an amount equal to 15% of the total contract, including the Change Orders/Supplemental Agreements, the insurance coverage included under this heading shall be increased accordingly. Proof of coverage shall be established by endorsement to the original policy or by reissue of the original policy to include the added coverage, or in accordance with any other acceptable policy of the insuring company for increasing the coverage.

34. CONTRACT BONDS:

In order to insure the faithful performance of each and every condition, stipulation, and requirement of the Contract, and to indemnify and save harmless the Owner from any and all damages, either directly or indirectly (arising out of any failure to perform same), the successful Bidder to whom the Contract is awarded shall, within ten (10) days from the date of the award, unless otherwise stipulated in the Modified General Conditions, furnish at his own expense and file with the Owner an acceptable Surety Bond in an amount equal to one hundred (100) percent of the contract bid price of the Contract as awarded. Said Bond shall be made on the approved bond form, shall be furnished by a reputable surety company authorized to do business in the State of Alabama, shall be countersigned by an authorized agent resident in the State who is qualified for the execution of such instruments, and shall have attached thereto power of attorney of the signing official. In case of default on the part of the Contractor, all expenses incident to ascertaining and collecting losses suffered by the Owner under the Bond, including architectural, engineering, administrative, and legal services, shall lie against the Contract Bond for Performance of the Work.

In addition thereto, the successful Bidder to whom the Contract is awarded shall, within ten (10) days, unless otherwise stipulated in the General Conditions, furnish at his expense and file with the Owner an acceptable surety bond for Payment of Labor, materials, equipment and supplies, payable to the Owner in an amount equal to fifty (50) percent of the Contract Price, with the obligation that the Contractor shall promptly make payment to all persons furnishing him or them with labor, materials, or supplies for, or in the prosecution of the Work, including the payment of reasonable attorneys fees incurred by successful claimants or plaintiffs in suits on said bond. The date of neither bond shall be earlier than the date of the Contract Agreement.

If any surety upon any bond furnished in connection with this contract becomes unacceptable to the State, or if any such surety shall fail to furnish reports as to his financial condition from time to time as requested by the State, the Contractor shall promptly furnish such additional security as may be required from time to time to protect the interests of the State or of persons supplying labor or materials in the prosecution of the work contemplated by the contract.

Bonds shall remain in force during the entire guarantee period stipulated in the Contract.

35. DAMAGES:

Should either party of the Contract suffer damages because of any wrongful act or neglect of the other party or of anyone employed by him, claim shall be made in writing to the other party within a reasonable time of the first observance of such damage, and not later than the date of the Application for Final Payment, except as expressly stipulated otherwise in the case of faulty work or materials.

36. LIENS:

The Owner may request a complete release of all liens and if this is done, neither the Final Payment nor any part of the retained percentage shall become due until the Contractor shall deliver to the Owner a complete release of all liens arising out of the Contract, and, an affidavit that so far as he has knowledge or information the releases include all the labor and material for which a lien could be filed; but the Contractor may, if any Subcontractor refuses to furnish a release or receipt in full, furnish a bond satisfactory to the Owner, to indemnify him against any lien. If any lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all moneys that the latter may be compelled to pay in discharging such a lien, including all costs and a reasonable attorney's fee.

37. ASSIGNMENT:

The Contractor shall not assign the Contract or sublet it as a whole without the written consent of the Owner, nor shall the Contractor assign any moneys due or to become due to him hereunder without the previous written consent of the Owner.

38. MUTUAL RESPONSIBILITY OF CONTRACTORS:

If the Contractor or any of his Subcontractors cause any loss or damage to any separate contractor with a prior, concurrent, or subsequent contract on the Work or on the site, or any undue delay to such separate contractor on the Work or on the site, and if such contractor makes claim against the Owner, on account of any loss so sustained, the Owner shall notify the Contractor who shall indemnify and save harmless the Owner against any expenses arising therefrom.

39. SEPARATE CONTRACTS:

The Owner may award other contracts for additional new construction, buildings or equipment, or for reconstruction, alteration, equipment, and improvement of existing buildings on the site, and the Contractor shall fully cooperate in the storage of materials and the detailed execution of work, coordinate and integrate his operations with such other contractors, and carefully fit his own work to that provided under other contracts, as he may be directed by the Contracting Officer. The Contractor shall not commit or permit any act which will interfere with the performance of work by any other contractor.

The Contractor, including his Subcontractors, shall keep himself informed of the progress and the detailed work of other contractors and shall notify the Contracting Officer immediately of lack of progress or defective workmanship on the part of other contractors, where such delay or such defective workmanship will interfere with his own operations of the work.

40. SUBCONTRACTS:

Concurrent with the execution of the Contract by the Contractor he shall submit in writing in five (5) counterparts to the Architect for approval by the Architect and the Contracting Officer the names of the Subcontractors proposed for the work. Subcontractors that have been so approved may not be changed thereafter except at the request of or with the approval of the Contracting Officer.

The Contractor shall not employ any subcontractor to whom the Owner or Contracting Officer may have any objection, but he will not be required to employ any subcontractor against whom he himself has a reasonable objection.

The Contractor shall be as fully responsible to the Owner for the acts and omissions of Subcontractors, and of persons employed by them, as he is for the acts and omissions of persons directly employed by him.

Nothing contained in the Contract Documents shall be construed as creating any contractual relationship between any Subcontractor and the Owner.

41. RELATIONS OF CONTRACTOR AND SUBCONTRACTORS:

The Contractor shall cause appropriate provisions to be inserted in all Subcontracts relative to the Work, to bind Subcontractors to the Contractor by the terms of the Contract Documents insofar as applicable to the work of Subcontractors, and to give the Contractor the same power as regards terminating any provisions of the Contract Documents.

The Articles, Divisions, Sections, or Paragraphs of the Specifications are not intended to control the Contractor in dividing the work among Subcontractors or to limit the work performed by any trade.

The Contractor shall be responsible for the coordination of Subcontractors, of the trades, and material men engaged upon his work.

The Contractor shall, without additional expense to the Owner, utilize the services of specialty subcontractors on those parts of the work which are specified to be performed by specialty subcontractors.

The Contracting Officer or the Architect will not undertake to settle any differences between the Contractor and his Subcontractors or between Subcontractors.

42. ARCHITECT'S STATUS:

The Architect named in the Contract Documents, who prepared and furnished the Working Drawings and the Specifications contained therein, will prepare details and explanatory drawings, and provide instructions during the progress of the work for transmittal by the Contracting Officer or Architect as above set forth under paragraph 3, ADDITIONAL DETAIL DRAWINGS AND INSTRUCTIONS. He will make his check of manufacturers' data and shop drawings submitted by the Contractor for the Work as above set forth under 5, SHOP DRAWINGS.

The Architect will endeavor to require the Contractor to strictly adhere to the plans and specifications, to guard the Owner against defects and deficiencies in the work of Contractors, and shall promptly notify the Contracting Officer in writing of any significant departure in the quality of materials or workmanship from the requirements of the plans and specifications, but he does not guarantee the performance of the contracts.

The Architect shall not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, unless spelled out in the Contract Documents, and he shall not be liable for results of the Contractor's failure to carry out the work in accordance with the Contract Documents.

The Architect shall have authority to require the Contractor to stop the Work whenever in his opinion it may be necessary for the proper performance of the Contract. The Architect shall not be liable to the Owner for the consequences of any decision made by him in good faith either to exercise or not to exercise his authority to stop the Work.

The Architect shall not be responsible for the acts or omissions of the Contractor, or any Subcontractors, or any of the Contractor's or Subcontractor's agents or employees, or any other persons performing any of the Work.

43. ARCHITECT'S DECISIONS:

The Architect's decisions in matters relating to the artistic effect of his work shall be final, if within the other terms of the Contract.

44. CONTRACTING OFFICER'S DECISIONS:

Except as hereinafter provided, any claim or question concerning the interpretation or meaning of the Contract Documents, or concerning a breach of the Contract, shall be submitted to the Contracting Officer and his decision shall be final, binding, and conclusive on the parties to the Contract. He shall have executive authority to enforce and make effective such decisions and orders as the Contractor fails to carry out promptly.

45. CASH ALLOWANCES:

No cash allowances shall be included in the Contract Price, unless specifically set forth under SPECIAL CONDITIONS or MODIFICATIONS of the GENERAL CONDITIONS. When so included, the Contractor shall include in the Contract Price all allowances named therein and shall cause the work so covered to be done by such subcontractors, material, and/or equipment men, and for such sums as the Contracting Officer approves, and the Contract Price shall be adjusted in conformance therewith. The Contract Price shall include all the Contractor's expense, overhead, and profit, and no allowance, other than that included in the Contract Price, will be paid by the Owner.

46. USE OF PREMISES; SANITARY PROVISIONS:

The Contractor shall take every precaution against injuries to persons or damages to property.

The Contractor shall comply with local and State regulations governing the operation of premises which are occupied and shall perform the Contract in such a manner as not to interrupt or interfere with the operation of any other facility.

The Contractor shall store his apparatus, materials, supplies, and equipment in such orderly fashion at the site of the Work as will not unduly interfere with the progress of his work or the work of any other contractors.

Unless otherwise provided, temporary storage sheds, shops, and office facilities may be erected on the premises with the approval of the Architect or the Contracting Officer. Such temporary buildings and/or utilities shall remain the property of the Contractor and be removed at his expense upon completion of the Work, unless the Owner authorized their abandonment without removal.

Necessary crossings of curbings, sidewalks, roadways, or parkways shall be protected against damage, and any damage shall be repaired by or at the expense of the Contractor.

The Contractor shall not place upon the Work or any part thereof loads inconsistent with the safety of that portion of the Work.

No Contractor shall perform any work necessary to be performed after regular working hours or on Sundays or legal holidays without extra compensation.

The Contractor shall provide and maintain such sanitary accommodations for the use of his employees and those of his subcontractors as may be necessary to comply with the requirements and regulations of the local and State Department of Health and as directed.

47. CUTTING AND PATCHING:

The Contractor shall do all necessary cutting, fitting, and patching of the Work that maybe required to properly receive the Work to make its several parts join together properly, receive and provide for the work of various trades, and be received by the work of other contractors, or as required by Drawings and Specifications to complete the Work. After such cutting, he shall replace or restore or repair and make good all defective or patched work as required by the Architect. He shall not cut, excavate, or otherwise alter any work in a manner or by a method or methods that will endanger the Work, adjacent property, workmen, the public, or the work of any other contractor.

The Contractor shall have his Subcontractor check the location of all sleeves, openings, slots, etc., for the piping, ducts, breeching, conduits, louvers, grilles, fans, etc., as they are laid out on the job.

Provision for openings, holes, and clearances through walls, beams, floors, ceilings, and partitions shall be made and checked by the Contractor and/or his Subcontractor in advance of constructing such parts of the Work, and unnecessary, superfluous or dangerous cutting avoided.

Pipes passing through concrete or masonry walls shall be protected by pipe sleeves two sizes larger than the pipe, plus its insulation, to provide free movement.

Under no condition shall structural, framing, or other parts or members subjected to computed stress be cut or disturbed without the approval of the Architect. Any plates, studs, or joists, and/or rafters that are approved to be cut to execute necessary work shall be securely strapped and braced to restore their original strength by an approved method.

The Architect's approval shall be obtained before cutting or drilling holes in concrete or masonry that tend to damage or weaken the load capacity.

48. PERIODIC AND FINAL CLEANUP:

The Contractor shall periodically, or as directed during the progress of the Work, clean up and remove from the premises all refuse, rubbish, scrap materials and debris caused by his employees, his Subcontractors, or resulting from his work, to the end that at all times the premises are sanitary, safe, reasonably clean, orderly, and workmanlike. Trash and combustible materials shall not be allowed to accumulate inside buildings or elsewhere on the premises. At no time shall any rubbish be thrown from window openings.

Before final completion and final acceptance the Contractor shall remove from the Owner's property, and from all public and private property, all tools, scaffolding, false work, temporary structures, and/or utilities

including the foundations thereof (except such as the Owner permits in writing to remain); rubbish and waste materials resulting from his operations or caused by his employees; and shall remove all surplus materials, leaving the site clean and true to line and grade, and the Work in a safe and clean condition, ready for use and operation.

In addition to the above, the Contractor shall be responsible for the following special cleaning for all trades as the work shall have been completed:

A. Cleaning of all painted, enameled, stained, or baked enamel work: Removal of all marks, stains, finger prints and splatters from such surfaces.

B. Cleaning of all glass: Cleaning and removing of all stickers, labels, stains, and paint from all glass, and the washing and polishing of same on interior and exterior.

C. Cleaning and polishing of all hardware.

D. Cleaning all tile, floor finish of all kinds: Removal of all splatter, stains, paint, dirt, and dust, the washing and polishing of all floors as recommended by the manufacturer or required by the Architect.

E. Cleaning of all manufactured articles, materials, fixtures, appliances, and equipment: Removal of all stickers, rust stains, labels, and temporary covers, and cleaning and conditioning of all manufactured articles, material, fixtures, appliances, and electrical, heating, and air conditioning equipment as recommended or directed by the manufacturers, unless otherwise required by the Architect; blowing out or flushing out of all foreign matter from all dust pockets, piping, tanks, pumps, fans, motors, devices, switches, panels, fixtures, boilers, similar features; and freeing identification plates on all equipment of excess paint and the polishing thereof.

In case of failure to comply with the above requirements for any part of the work within the time specified by the Architect, he may cause the Work to be done and deduct the cost thereof from the Contract Price on the next or succeeding Application for Payment.

49. GUARANTEE OF THE WORK:

Except as otherwise specified in the General Conditions or the Special Conditions, all work shall be guaranteed by the Contractor against defects resulting from the use of inferior materials, equipment, or workmanship for one year from the date of final completion of the Contract, or from full occupancy of the building by the Owner, whichever is earlier.

If, within any guarantee period, repairs or changes are required in connection with guaranteed work, which, in the opinion of the Contracting Officer or Architect are required as the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract requirements, the Contractor, shall, promptly upon receipt of notice from the Owner, and without expense to the Owner:

A. Place in satisfactory condition in every particular all of such guaranteed work, correct all defects therein; and

B. Make good all damage to the building or site, or equipment or contents thereof, which, in the opinion of the Contracting Officer or Architect, is the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract; and

C. Make good any work or material, or the equipment and contents of said building or site disturbed in fulfilling any such guarantee.

In any case where in fulfilling the requirements of the Contract or of any guarantee, embraced in or required thereby, the Contractor disturbs any work guaranteed under another contract, he shall restore such disturbed work to a condition satisfactory to the Contracting Officer and guarantee such restored work to the same extent as it was guaranteed under such other contract.

If the Contractor, after notice, fails to proceed promptly to comply with the terms of the guarantee, the Owner may have the defects corrected and the Contractor and his Surety shall be liable for all expense incurred.

All special guarantees applicable to definite parts of the work that may be stipulated in the Contract Documents shall be subject to the terms of this paragraph during the first year of the life of such special guarantee.

50. POSSESSION PRIOR TO COMPLETION:

The Owner shall have the right to use any completed or partially completed part of the Work. Such use shall not be deemed an acceptance of any work not completed in accordance with the contract requirements. If, however, such prior use by the Owner delays the progress of the Work or causes additional expenses to the Contractor, an equitable adjustment in the Contract Price and/or time of completion will be made and the Contract will be modified in writing accordingly.

51. LIQUIDATED DAMAGES:

Time is the essence of the Contract. Any delay in the completion of the Work as provided for in the Contract Documents will cause inconvenience to the public and loss and damage to the Owner in interest, and in additional administrative, architectural, inspection and supervision charges.

Therefore, a time charge equal to six per cent interest per annum on the total Contract Price will be made against the Contractor for the entire period that any part of the Work remains uncompleted after the time specified for the completion of the Work as provided in the Contract Documents, the amount of which shall be deducted by the Contracting Officer from the Final Estimate, and shall be retained by the Contracting Officer out of moneys otherwise due the Contractor in the Final Payment, not as a penalty, but as liquidated damages sustained, it being mutually understood and agreed between the parties hereto that such amount is reasonable as liquidated damages.

52. USE OF FOREIGN MATERIALS:

In accordance with ACT 876 of the 1961 Regular Session of the Alabama legislature the Contractor shall use only materials, supplies, and products manufactured, mined, processed or otherwise produced in the United States or its territories, if same are available at reasonable prices.

Breaching of this agreement shall render the Contractor liable for payment of liquidated damages in the amount of not less than \$500.00 nor more than 20% of the gross amount of the contract.

This requirement applies to all contracts for public works financed entirely with State of Alabama funds.

53. WITHHOLDING OF FUNDS (1977 DEC)

A. The Contracting Officer may withhold or cause to be withheld from the prime contractor so much of the accrued payments or advances as maybe considered necessary (1) to pay laborers and mechanics, including apprentices, trainees, watchmen and guards, employed by the Contractor or any subcontractor on the work the full amount of wages required by the contract, and (2) to satisfy any liability of the Contractor and any subcontractor for liquidated damages under paragraph (B) of the clause entitled "Contract Work Hours and Safety Standards Act - Overtime Compensation."

B. If the Contractor or any subcontractor fails to pay any laborer, mechanic, apprentice, trainee, watchman, or guard employed or working on the site of the work all or part of the wages required by the contract, the Contracting Officer may, after written notice to the prime contractor, take such action as may be necessary to cause suspension of any further payments or advances until such violations have ceased.

54. DISPUTES CONCERNING LABOR STANDARDS (ASPR 7-602.23)(77 DEC)

Disputes arising out of the labor standards provisions of this contract shall be subject to the DISPUTES clause except to the extent such disputes involve the meaning of classifications or wage rates contained in the wage determination decision of the Secretary of Labor or the applicability of the labor provisions of this

contract which questions shall be referred to the Secretary of Labor in accordance with the procedures of the Department of Labor.

55. DISPUTES

Except as otherwise specifically provided in this contract, and except as otherwise specifically provided by the State procedure for arbitration or other State procedure established by State law, any dispute concerning a question of fact arising under this contract which is not disposed of by mutual agreement shall be decided by the Contracting Officer, who shall reduce his decision to writing and send by registered mail, return receipt requested, a copy thereof to the Contractor at his address shown herein. Within thirty (30) days after the date of receipt of such copy, the Contractor may appeal in writing to the Governor of this State, whose written decision therein, or that of his designated representative or representatives, shall, unless determined by a court of competent jurisdiction to have been fraudulent or capricious or arbitrary or so grossly erroneous as necessarily to imply bad faith, or not supported by substantial evidence, be final and conclusive: Provided, that if no such appeal is taken, the decision of the Contracting Officer shall be final and conclusive. The Governor of this State may designate an individual or individuals other than the Contracting Officer, or a board, as his authorized representative to determine appeals under this Article. In connection with any appeal proceeding under this Clause, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of his appeal. Pending final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the contract and in accordance with the Contracting Officer's decision. Any sum or sums allowed to the Contractor under the provisions of this Article or under the State Arbitration proceedings or under other State procedure shall be paid subject to approval of the Chief, National Guard Bureau, for the Government's share of the cost of the Articles or work herein disputed as deemed to be within the contemplation of this contract.

56. EQUAL OPPORTUNITY (FEDERALLY ASSISTED CONSTRUCTION) (ASPR 7-103.18)(1978 SEP)

If, during any twelve (12) month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded Federal contracts and/or subcontracts which have an aggregate value in excess of \$10,000, the Contractor shall comply with (A) through (G) below. Upon request, the Contractor shall provide information necessary to determine the applicability of this clause.)

The applicant hereby agrees that it will incorporate or cause to be incorporated into any contract for construction work, or modification thereof, as defined in the Regulations of the Secretary of Labor at 41 CFR Chapter 60, which is paid for in whole or in part with funds obtained from the Federal Government or borrowed on the credit of the Federal Government pursuant to a grant, contract, loan, insurance, or guarantee, or undertaken pursuant to any Federal program involving such grant, contract, loan, insurance, or guarantee, the following Equal Opportunity clause:

During the performance of this contract, the Contractor agrees as follows:

A. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include but not be limited to the following: Employment, upgrading, demotion, or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

B. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.

C. The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers representatives of the Contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

D. The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and of the rules, regulations and relevant orders of the Secretary of Labor.

E. The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

F. In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations or orders, this contract may be cancelled, terminated or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts or Federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, or by rule, regulation or order of the Secretary of Labor, or as otherwise provided by law.

The Contractor will include the portion of the sentence immediately preceding paragraph (A) and G. the provisions of paragraphs (A) through (G) in every subcontract or purchase order unless exempted by rules, regulations or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event a Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States. The applicant further agrees that it will be bound by the above Equal Opportunity Clause with respect to its own employment practices when it participates in Federally assisted construction work: Provided, that if the applicant so participating is a State or local government, the above Equal Opportunity Clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract. The applicant agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of Contractors and subcontractors with the Equal Opportunity Clause and the rules, regulations and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance. The applicant further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, with a Contractor debarred from, or who has not demonstrated eligibility for, Government contracts and Federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the Equal Opportunity Clause as may be imposed upon Contractors and subcontractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the applicant agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: cancel, terminate or suspend in whole or in part this grant (contract, loan, insurance, guarantee); refrain from extending any further assistance to the applicant under the program with respect to which the failure or refusal occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case to the Department of Justice for appropriate legal proceedings.

57. CERTIFICATION OF NONSEGREGATED FACILITIES (1970 AUG) (ASPR 7-2003.14)

(Applicable to contracts, subcontracts, and to agreements with applicants who are themselves performing Federally assisted construction contracts, exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity Clause). By the submission of this bid, the bidder, offeror, applicant, or subcontractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities at any of his establishments, and that he does not permit his establishments, and that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained.

maintained. The bidder, offeror, applicant, or subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion or national origin, because of habit, local custom or otherwise. He further agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors for subcontracts exceeding \$10,000 which are not exempt from the provisions of Equal Opportunity Clause; that he will retain such certifications in his files; and that he will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods).

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES:

A Certification of Nonsegregated Facilities must be submitted prior to the award of a subcontract exceeding \$10,000 which is not exempt from the provisions of the Equal Opportunity Clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

58. EXEMPTIONS TO EQUAL OPPORTUNITY CLAUSES (ASPR 12-805) (JUL 76)

A. Transactions of \$10,000 or Under. Contracts and subcontracts not exceeding \$10,000, other than Government bills of lading, are exempt from the requirements of the Equal Opportunity Clause. In determining the applicability of this exemption to any Federally assisted construction contract, or subcontract thereunder, the amount thereof rather than the amount of the Federal financial assistance shall govern. Indefinite delivery type contracts and subcontracts thereunder, basic agreements and basic ordering agreements shall include the Equal Opportunity Clause, except when the Contracting Officer (in the case of subcontractors, the prime contractor or subcontractors issuing the subcontract) determines that the amount to be ordered is not expected to extend \$10,000 in any single year. The applicability of the Equal Opportunity Clause shall be determined by the Contracting Officer at the time of award for the first year, and annually thereafter for succeeding years if any. Notwithstanding the above, the Equal Opportunity Clause shall be incorporated into such contract, subcontract, basic agreement or basic ordering agreement whenever the amount of a single order or procurement action exceeds \$10,000. Once the clause is incorporated, the contract, subcontract, basic agreement, or basic ordering agreement shall continue to be subject to such clause for its duration, regardless of the amounts ordered, or reasonably expected to be ordered, in any year. No Contracting Officer, Contractor, or Subcontractor, shall procure supplies or services in less than usual quantities to avoid applicability of the Equal Opportunity Clause.

B. Work Outside the United States. Contracts and subcontracts are exempt from the requirement of the Equal Opportunity Clause with regard to work performed outside the United States by employees who were not recruited within the United States.

C. Contracts with State or Local Governments. The requirements of the clause in any contract or subcontract with a State or local government (or any agency, instrumentality or subdivision thereof) shall not be applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract or subcontract. In addition, State and local governments are exempt from the requirements of filing the annual compliance report provided for by 12-812(a) and maintaining a written affirmative action program prescribed by 12-807.1.

D. Contracts Exempted by the Secretary of Defense in the Interest of National Security.

(1) Any requirement set forth in this Part shall not apply to any contract or subcontract whenever the Secretary of Defense determines that such contract or subcontract is essential to the national security and that its award without complying with such requirement is necessary to the national security.

(2) Requests for Exemption: The Contracting Officer shall prepare a detailed justification for such determination which shall be submitted to the ASD(M&RA) in accordance with Departmental procedures.

The ASD(M&RA) shall submit the request for exemption to the Secretary of Defense for approval, and shall notify the Director, OFCC, within 30 days of such a determination.

E. Specific Contracts and Facilities Exempted by the Director, OFCC.

(1) Specific Contracts. The Director, OFCC, may exempt an agency or person from requiring the inclusion of any or all of the Equal Opportunity Clause in any specific contract or subcontract when he deems that special circumstances in the national interest so require. He may also exempt groups or categories of contracts or subcontracts of the same type where he finds it impracticable to act upon each request individually or where group exemptions will contribute to convenience in the administration of the Order.

(2) Facilities Not Connected with Contracts. The Director, OFCC, may exempt from the requirements of the clause any of a prime contractor's or a subcontractor's facilities which he finds to be in all respects separate and distinct from activities of the prime contractor or subcontractor related to the performance of the contract or subcontract, provided that he also finds that such an exemption will not interfere with or impede the effectuation of the Order.

(3) Special Circumstances. The Director, OFCC, may exempt a contract or subcontract when he finds that special circumstances indicate that use of either of the clauses in 7-103.18 in the contract or subcontract would not be in the national interest.

(4) Request for Exemptions. The Contracting Officer shall submit a detailed justification for omitting or modifying the clause under (1), (2) or (3) above to the ASD (M&RA) in accordance with Departmental procedures.

(5) Withdrawal of Exemption by the Director, OFCC. When any contract or subcontract is of a class exempted under this paragraph 12-805, the Director, OFCC, may withdraw the exemption for a specific contract or subcontract or group of contracts or subcontracts when in his judgement such action is necessary or appropriate to achieve the purposes of the Order. Such withdrawal shall not apply to contracts or subcontracts awarded prior to the withdrawal. In procurements entered into by formal advertising or the various forms of restricted formal advertising, such withdrawal shall not apply unless the withdrawal is made more than 10 calendar days before the date set for the opening of the bids.

59. CLEAN AIR AND WATER (1975 OCT)(ASPR 7-103.29)

(Applicable only if the contract exceeds \$100,000, or the Contracting Officer has determined that orders under an indefinite quantity contract in any one year will exceed \$100,000, or a facility to be used has been the subject of a conviction under the Clean Air Act (42 U.S.C. 1857c-8(c)(1) or the Federal Water Pollution Control Act (33 U.S.C. 1319(c) and is listed by EPA, or the contract is not otherwise exempt.)

A. The Contractor agrees as follows:

(1) To comply with all the requirements of Section 114 of the Clean Air Act, as amended (42 U.S.C. 1857, et seq., as amended by Public Law 91-604) and Section 308 of the Federal Water Pollution Control Act (33 U.S.C. 1251, as amended by Public Law 92-500), respectively, relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in Section 114 and Section 308 of the Air Act and the Water Act, respectively, and all regulations and guidelines issued thereunder before the award of this contract.

(2) That no portion of the work required by this prime contract will be performed in a facility listed on the Environmental Protection Agency List of Violating Facilities on the date this contract was awarded unless and until the EPA eliminates the name of such facility or facilities from such listing.

(3) To use his best efforts to comply with clean air standards and clean water standards at the facilities in which the contract is being performed; and

(4) To insert the substance of the provisions of this clause in any nonexempt subcontract, including this paragraph (4).

B. The terms used in this clause have the following meanings:

(1) The term "Air Act" means the Clean Air Act, as amended (42 U.S.C. 1857 et seq., as amended by Public Law 91-604).

(2) The term "Air Act" means Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq., as amended by Public Law 92-500).

(3) The term "Clean Air Standards" means any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, or other requirements which are contained in, issued under, or otherwise adopted pursuant to the Air Act or Executive Order 11738, an applicable implementation plan as described in Section 110(d) of the Clean Air Act (42 U.S.C. 1857c-5(d), an approved implementation procedure or plan under Section 111(c) or Section 111(d), respectively of the Air Act (42 U.S.C. 1857c-6(c) or (d), or an approved implementation procedure under Section 112(d) of the Air Act (42 U.S.C. 1857c-7(d).

(4) The term "Clean Water Standards" means any enforceable limitation, control, condition, prohibition, standard or other requirement which is promulgated pursuant to the Water Act or obtained in a permit issued to a discharger by the Environmental Protection Agency or by a State under an approved program, as authorized by Section 402 of the Water Act (33 U.S.C. 1342), or by a local government to ensure compliance with pretreatment regulations as required by Section 307 of the Water Act (33 U.S.C. 1317).

(5) The term "compliance" means compliance with clean air or water standards. Compliance shall also mean compliance with a schedule or plan ordered or approved by a court of competent jurisdiction, the Environmental Protection Agency or an air or water pollution control agency in accordance with the requirement of the Air Act or Water Act and regulations issued pursuant thereto.

(6) The term "facility" means any building, plant, installation, structure, mine, vessel or other floating craft, location, or site of operations, owned, leased, or supervised by a contractor, subcontractor, to be utilized in the performance of a contract or subcontract. Where a location or site of operations contains or includes more than one building, plant, installation, or structure, the entire location or site shall be deemed to be a facility except there the Director, Office of Federal Activities, Environmental Protection Agency, determines that independent facilities are collocated in one geographical area.

(7) The term "nonexempt contract or subcontract" means a contract or subcontract of more than \$100,000 which is not otherwise exempted pursuant to the EPA regulations implementing the Air Act and Water Act (40 CFR 15.5), as further implemented in ASPR 1-2302.4 or in FPR 1-1.2302-4 whichever is applicable) and the procedures of the Department awarding the contract.

60. CLEAN AIR AND WATER CERTIFICATION (77 JUN) (DAR 7-2003.71)

Applicable if the bid or offer exceeds \$100,000, or the Contracting Officer has determined that orders under an indefinite quantity contract in any year will exceed \$100,000, or a facility to be used has been the subject of a conviction under the Clean Air Act (42 U.S.C. 1857c-8(c)(1)) or the Federal Water Pollution Control Act (33 U.S.C. 1319(c)) and is listed by EPA, or is not otherwise exempt.

The Bidder or offeror certifies as follows:

(1) Any facility to be utilized in the performance of this proposed contract is (_) or is not (_), listed on the Environmental Protection Agency List of Violating Facilities;

(2) He will promptly notify the Contracting Officer, prior to award, of the receipt of any communication from the Director, Office of Federal Activities, U. S. Environmental Protection Agency, indicating that any facility which he proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities; and

(3) He will include substantially this solicitation certification, including this paragraph (3), in every nonexempt subcontract.

GENERAL CONDITIONS of the CONTRACT

61. EXEMPTIONS TO ENVIRONMENTAL PROTECTION CLAUSE (ASPR 1-2302.4) (JUL 76)

Except as provided in (c) below, contracts and subcontracts are exempt from the requirements of this Part and 40 CFR Part 15, as follows:

A. Contracts and subcontracts not exceeding \$100,000 are exempt.

B. Contracts and subcontracts for indefinite quantities are exempt if the Contracting Officer determines that the amount to be ordered in any year under such contract will not exceed \$100,000.

C. Except for small purchases, the foregoing exemptions shall not apply to a proposed contract under which the facility to be used is listed on the EPA List of Violating Facilities on the basis of a conviction either under the Air Act (40 U.S.C. 1857-8(c)(1) or the Water Act (33 U.S.C. 1319(c)).

D. This part and 40 CFR Part 15 do not apply to the use of facilities located outside the United States. The term "United States," as used herein, includes the States, District of Columbia, Commonwealth of Puerto Rico, Virgin Islands, Guam and American Samoa, and Trust Territories of the Pacific Islands.

E. Upon a determination that the paramount interest of the United States so requires, the Secretary concerned may except from the provisions of this Part any individual or class of contracts or subcontracts, for a period of one year. Prior to granting a class exemption, the Secretary shall consult with the Director, Office of Federal Activities, United States Environmental Protection Agency. The Secretary granting either an individual contract or class exemption shall notify the Director of such exemption as soon after granting the exemption as practicable. Such notification shall describe the purpose of the contract, and indicate the manner in which the paramount interest of the United States required that the exemption be made.

62. AFFIRMATIVE ACTION FOR HANDICAPPED WORKERS (ASPR 7-103.28) (76 MAY)

A. The Contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant for employment is qualified. The Contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon either physical or mental handicap in all employment practices such as the following: employment, upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

B. The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

C. In the event of the Contractor's noncompliance with the requirements of this clause, action for noncompliance may be taken in accordance with the rules, regulations and relevant orders of the Secretary of Labor issued pursuant to the Act.

D. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, provided by or through the Contracting Officer. Such notices shall state the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified handicapped employees and applicants for employment, and the rights of applicants and employees.

E. The Contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Rehabilitation Act of 1973, and is committed to take affirmative action to employ and advance in employment physically and mentally handicapped individuals.

F. The Contractor will include the provisions of this clause in every subcontract or purchase order of \$2500 or more unless exempt by rules, regulations, or orders of the Secretary issued pursuant to Section 503 of the Act, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for noncompliance.

63. COVENANT AGAINST CONTINGENT FEES

The Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business. For breach or violation of this warranty, the Owner shall have the right to annul this contract without liability or in its discretion to deduct from the contract price or consideration the full amount of such commission, percentage, brokerage, or contingent fee.

64. OFFICIALS NOT TO BENEFIT

No member of or delegate to Congress or resident commissioner shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

65. CONVICT LABOR

In connection with the performance of work under this contract, the Contractor agrees not to employ any person undergoing sentence of imprisonment, as provided by Public Law 89-176, September 10, 1965 (18 U.S.C. 4082(c)(2)) and Executive Order 11755, December 29, 1973.

66. NONDISCRIMINATION IN EMPLOYMENT

In connection with the performance of work under this contract, the Contractor agrees not to discriminate against any employee or applicant for employment because of sex, race, creed, color, or national origin; and further agrees to insert the foregoing provision in all subcontracts hereunder except subcontracts for standard commercial supplies or for raw materials.

67. GRATUITIES

A. The State may, by written notice to the Contractor, terminate the right of the Contractor to proceed under this contract if it is found, after notice and hearing, by the Contracting Officer or Governor or the duly authorized representative of either, that gratuities (in the form of entertainment, gifts, or otherwise) were offered or given by the Contractor, or any agent or representative of the Contractor, to any officer or employee of the State with a view toward securing a contract or securing favorable treatment with respect to the awarding or amending, or the making of any determinations with respect to the performance of such contract: Provided, that the existence of the facts upon which the Contracting Officer or Governor or the duly authorized representative of either makes such findings shall be in issue and may be reviewed in any competent court.

B. In the event this contract is terminated as provided in paragraph (a) hereof, the State shall be entitled (1) to pursue the same remedies against the Contractor as it could pursue in the event of a breach of the contract by the Contractor, and (2) as a penalty in addition to any other damages to which it may be entitled by law, to exemplary damages in an amount (as determined by the Contracting Officer or Governor or the duly authorized representative of either) which shall not be less than 3 nor more than 10 times the costs incurred by the Contractor in providing any such gratuities to any such officer or employee.

C. The rights and remedies of the State provided in this Clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

68. COPELAND ("ANTI-KICKBACK") ACT - NONREBATE OF WAGES

The regulations of the Secretary of Labor applicable to contractors and subcontractors (29 CFR, Part 3), made pursuant to the Copeland Act, as amended (40 U.S.C. 276c) and to aide in the enforcement of the Anti-Kickback Act (18 U.S.C. 874) are made a part of this contract by reference. The Contractor will comply with these regulations and any amendments or modifications thereof and the prime contractor will be responsible for the submission of affidavits required of subcontractors thereunder. The foregoing shall apply except as the Secretary of Labor may specifically provide for reasonable limitations, variations, tolerances and exemptions.

69. SUBCONTRACTS - TERMINATION

The Contractor agrees to insert the clauses hereof entitled <u>COPELAND ("ANTI-KICKBACK") ACT -</u> <u>NONREBATE OF WAGES</u>, <u>WITHHOLDING OF FUNDS</u>, and <u>SUBCONTRACTS - TERMINATION</u> physically in all subcontracts and the Contractor further agrees that a breach of any of the requirements of these clauses may be grounds for termination of this contract. The term "contractor" as used in such clauses in any subcontract shall be deemed to refer to the subcontractor except in the phrase "prime contractor."

70. AUDIT BY DEPARTMENT OF DEFENSE (1978 AUG)

A. <u>General</u>. The Contracting Officer or his representatives shall have the audit and inspection rights described in the applicable paragraphs (B), (C) and (D) below.

B. <u>Examination of Costs</u>. If this is a cost reimbursement type, incentive, time and materials, labor hour, or price redeterminable contract, or any combination thereof, the Contractor shall maintain, and the Contracting Officer or his representatives shall have the right to examine books, records, documents, and other evidence and accounting procedures and practices, sufficient to reflect properly all direct and indirect costs of whatever nature claimed to have been incurred and anticipated to be incurred for the performance of this contract. Such right of examination shall include inspection at all reasonable times of the Contractor's plants, or such parts thereof, as may be engaged in the performance of this contract.

C. <u>Cost or Pricing Data</u>. If the Contractor submitted cost or pricing data in connection with the pricing of this contract or any change or modification thereto, unless such pricing was based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the general public, or prices set by law or regulation, the Contracting Officer or his representatives who are employees of the United States Government shall have the right to examine all books, records, documents and other data of the Contractor related to the negotiation, pricing or performance of such contract, change or modification, for the purpose of evaluating the accuracy, completeness and currency of the cost or pricing data submitted. The right of examination shall extend to all documents necessary to permit adequate evaluation of the cost or pricing data submitted, along with the computations and projections used therein.

D. <u>Reports</u>. If the Contractor is required to furnish Contractor Cost Data Reports (CCDR), Contract Fund Status Reports (CFSR), or Cost Performance Reports (CPR), the Contracting Officer or his representatives shall have the right to examine books, records, other documents, and other supporting materials, for the purpose of evaluating (i) the effectiveness of the Contractor's policies and procedures to produce data compatible with the objectives of these reports, and (ii) the data reported.

E. <u>Availability</u>. The materials described in (B), (C) and (D) above shall be made available at the office of the Contractor, at all reasonable times, for inspection, audit, or reproduction, until the expiration of three (3) years from the date of final payment under this contract or such lesser time specified in Appendix M of the Defense Acquisition Regulation and for such longer period, if any, as is required by applicable statute, or by other clauses of this contract, or by (1) and (2) below:

(1) If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for a period of three (3) years from the date of any resulting final settlement.

(2) Records which relate to appeals under the <u>DISPUTES</u> Clause of this contract, or litigation, or the settlement of claims arising out of the performance of this contract, shall be made available until such appeals, litigation, or claims have been disposed of.

F. The Contractor shall insert a clause containing all the provisions of this clause, including this paragraph (F), in all subcontracts exceeding \$10,000 hereunder, except altered as necessary for proper identification of the contracting parties and the Contracting Officer under the State prime contract.

71. SUBCONTRACTOR COST OR PRICING DATA - PRICE ADJUSTMENTS (1970 JAN)

A. Paragraphs (B) and (C) of this Clause shall become operative with respect to any modification made pursuant to one or more provisions of this contract which involves aggregate increases and/or decreases in costs plus applicable profits expected to exceed \$100,000. The requirements of this Clause shall be limited to such modifications.

B. The Contractor shall require subcontractors hereunder to submit cost or pricing data under the following circumstances:

prior to the award of any subcontract the amount of which is expected to exceed \$100,000 when entered into;

(2) prior to the pricing of any subcontract modification which involves aggregate increases and/or decreases in costs plus applicable profits expected to exceed \$100,000; except where the price is based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the general public, or prices set by law or regulation.

C. The Contractor shall insert the substance of this clause including this paragraph (C) in each subcontract which exceeds \$100,000.

72. BUY AMERICAN ACT (1966 OCT)

A. <u>Agreement</u>. In accordance with the Buy American Act (41 U.S.C. I0a - I0d), the Contractor agrees that only domestic construction material will be used (by the Contractor, subcontractors, materialmen, and suppliers) in the performance of this contract, except for non-domestic construction material listed in the "Nondomestic Construction Materials" clause, if any, of this contract.

B. <u>Domestic construction material</u>. "Construction material" means any article, material, or supply brought to the construction site for incorporation in the building or work. An unmanufactured construction material is a "domestic construction material" if it has been mined or produced in the United States. A manufactured construction material is a "domestic construction material" if it has been mined, produced, or manufactured in the United States and if the cost of its components which have been mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. "Component" means any article, material, or supply directly incorporated in a construction material.

C. <u>Domestic component</u>. A component shall be considered to have been mined, produced, or manufactured in the United States" (regardless of its source in fact) if the article, material, or supply in which it is incorporated was manufactured in the United States and the component is of a class or kind determined by the Government to be not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality.

D. <u>Non-Domestic construction material</u>. The Contractor/Vendor agrees that it will not expend any funds appropriated by Congress without complying with The Buy American Act (41 U.S.C. 10). The Buy American Act gives preference to domestic end products and domestic construction material. In addition, the Memorandum of Understanding between the United States of America and the European Economic Community on Government Procurement, and the North American Free Trade Agreement (NAFTA), provide that EC and NAFTA end products and construction materials are exempted from application of the Buy American Act.

73. APPROVAL

This contract and any subsequent terminations, modifications, or change orders (including those resulting from disputes and settlements of disputes) shall be subject to the written approval of the Chief, National Guard Bureau, or his duly authorized representative, and shall not be binding until so approved.

74. SUBJECT TO FEDERAL-STATE AGREEMENT

This contract is subject to all terms and conditions of the Federal-State Agreement between the United States of America and the State of Alabama.

75. RELATIONSHIP OF THE FEDERAL GOVERNMENT

This contract is funded in part by the Federal Government. The Federal Government is not a party to this contract. As a condition to receiving and expending Federal funds, there are certain rights of Federal inspection, Federal approval of contract changes and modifications, and Federal approval of settlements or dispute actions that the Federal Government will exercise prior to authorization of Federal funds. Therefore, no inspection or acceptance, change, modification, settlement, dispute claim payment, or dispute action will be

considered binding until the required Federal approval is obtained. The Chief, National Guard Bureau, or his designated representative, is the approval authority. This paragraph does not abrogate any rights conferred on the Federal Government by law or other clause required due to the use of Federal funding.

76. SUSPENSION OF WORK (1968 FEB) (DAR 7-602.46)

A. The Contracting Officer may order the Contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as he may determine to be appropriate for the convenience of the Owner.

B. If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted by an act of the Contracting Officer in the administration of this contract, or by his failure to act within the time specified in this contract (or if no time is specified, within a reasonable time), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by such unreasonable suspension, delay, or interruption and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent (1) that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or (2) for which an equitable adjustment is provided for or excluded under any other provision of this contract.

C. No claim under this clause shall be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim, in a amount stated, is asserted in writing as soon as practicable after the termination of such suspension, delay, or interruption, but not later than the date of final payment under the contract.

77. TERMINATION FOR CONVENIENCE OF THE OWNER - CONSTRUCTION (1974 APR) (DAR 7-602.29)

A. The performance of work under this contract may be terminated by the Owner in accordance with this clause in whole, or from time to time in part, whenever the Contracting Officer shall determine that such termination is in the best interest of the Owner. Any such termination shall be effected by delivery to the Contractor of a Notice of Termination specifying the extent to which performance of work under the contract is terminated, and the date upon which such termination becomes effective.

B. After receipt of a Notice of Termination, and except as otherwise directed by the Contracting Officer, the Contractor shall:

(1) Stop work under the contract on the date and to the extent specified in the Notice of Termination;

(2) Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the work under the contract as is not terminated;

(3) Terminate all orders and subcontracts to the extent that they relate to the performance of work terminated by the Notice of Termination;

(4) Assign to the Owner, in the manner, at the times, and to the extent directed by the Contracting Officer, all of the right, title, and interest of the Contractor under the orders and subcontracts so terminated, in which case the Owner shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;

(5) Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts, with the approval or ratification of the Contracting Officer, to the extent he may require, which approval or ratification shall be final for all the purposes of this clause;

(6) Transfer title and deliver to the Owner, in the manner, at the times, and to the extent, if any, directed by the Contracting Officer, (a) the fabricated or unfabricated parts, work in process, completed work, supplies, and other materials produced as a part of, or required in connection with the performance of, the work terminated by the Notice of Termination, and (b) the completed or partially completed plans,

drawings, information, and other property which, if the contract had been completed, would have been required to be furnished to the Owner;

(7) Use his best efforts to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by the Contracting Officer, any property of the types referred to in (6) above; provided, however, that the Contractor (a) shall not be required to extend credit to any purchaser, and (b) may acquire any such property under the conditions prescribed by and at a price or prices approved by the Contracting Officer; and provided further that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the Owner to the Contractor under this contract or shall otherwise be credited to the price or cost of the work covered by this contract or paid in such other manner as the Contracting Officer may direct;

(8) Complete performance of such part of the work as shall not have been terminated by the Notice of Termination; and

(9) Take such action as may be necessary, or as the Contracting Officer may direct, for the protection and preservation of the property related to this contract which is in the possession of the Contractor and in which the Owner has or may acquire an interest.

At any time after expiration of the plant clearance period, as defined in Section VIII, Armed Services Procurement Regulation, as it may be amended from time to time, the Contractor may submit to the Contracting Officer a list, certified as to quantity and quality, of any or all items of termination inventory not previously disposed of, exclusive of items the disposition of which has been directed or authorized by the Contracting Officer, and may request the Owner to remove such items or enter into a storage agreement covering them. Not later than fifteen (15) days thereafter, the Owner will accept title to such items and remove them or enter into a storage agreement covering the same; provided, that the list submitted shall be subject to verification by the Contracting Officer upon removal of the items, or if the items are stored, within forty-five (45) days from the date of submission of the list, and any necessary adjustment to correct the list as submitted shall be made prior to final settlement.

C. After receipt of a Notice of Termination, the Contractor shall submit to the Contracting Officer his termination claim, in the form and with certification prescribed by the Contracting Officer. Such claim shall be submitted promptly but in no event later than one year from the effective date of termination, unless one or more extensions in writing are granted by the Contracting Officer, upon request of the Contractor made in writing within such one year period or authorized extension thereof. However, if the Contracting Officer determines that the facts justify such action, he may receive and act upon any such termination claim at any time after such one year period or any extension thereof. Upon failure of the Contractor to submit his termination claim within the time allowed, the Contractor gofficer may determine, on the basis of information available to him, the amount, if any, due to the Contractor by reason of the termination and shall thereupon pay to the Contractor the amount so determined.

D. Subject to the provisions of paragraph C, the Contractor and the Contracting Officer may agree upon the whole or any part of the amount or amounts to be paid to the Contractor by reason of the total or partial termination of work pursuant to this clause, which amount or amounts may include a reasonable allowance for profit on work done; provided, that such agreed amount or amounts, exclusive of settlement costs, shall not exceed the total contract price as reduced by the amount of payments otherwise made and as further reduced by the contract price of work not terminated. The contract shall be amended accordingly, and the Contractor shall be paid the agreed amount. Nothing in paragraph E of this clause, prescribing the amount to be paid to the Contractor by reason of the termination of work pursuant to this clause, shall be deemed to limit, restrict, or otherwise determine or affect the amount or amounts which may be agreed upon to be paid to the Contractor pursuant to this paragraph D.

E. In the event of the failure of the Contractor and the Contracting Officer to agree, as provided in paragraph D, upon the whole amount to be paid to the Contractor by reason of the termination of work pursuant to this clause, the Contracting Officer shall pay to the Contractor the amounts determined by the Contracting Officer as follows, but without duplication of any amounts agreed upon in accordance with paragraph D:

(1) With respect to all contract work performed prior to the effective date of the Notice of Termination, the total (without duplication of any items) of:
(a) the cost of such work;

(b) the cost of settling and paying claims arising out of the termination of work under subcontracts or orders as provided in paragraph B(5) above, exclusive of the amounts paid or payable on account of supplies or materials delivered or services furnished by the subcontractor prior to the effective date of the Notice of Termination of Work under this contract, which amounts shall be included in the cost on account of which payment is made under (A) above, and

(c) a sum, as profit on "a" above, determined by the Contracting Officer pursuant to 8-303 of the Armed Services Procurement Regulation, in effect as of the date of execution of this contract, to be fair and reasonable; provided, however, that if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, no profit shall be included or allowed under this subdivision "c" and an appropriate adjustment shall be made reducing the amount of the settlement to reflect the indicated rate of loss; and

(2) The reasonable cost of the preservation and protection of property incurred pursuant to paragraph B(9); and any other reasonable cost incidental to termination of work under this contract, including expense incidental to the determination of the amount due to the Contractor as the result of the termination of work under this contract.

The total sum to be paid to the Contractor under (1) above shall not exceed the total contract price as reduced by the amount of payments otherwise made and as further reduced by the contract price of work not terminated. Except for normal spoilage, and except to the extent that the Owner shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor under (1) above, the fair value, as determined by the Contracting Officer, of property which is destroyed, lost, stolen, or damaged so as to become undeliverable to the Owner, or to a buyer pursuant to paragraph B(7).

F. Costs claimed, agreed to, or determined pursuant to C, D, E, and I hereof shall be in accordance with Section XV of the Armed Services Procurement Regulation as in effect on the date of this contract.

G. The Contractor shall have the right of appeal, under the clause of this contract entitled "Disputes", from any determination made by the Contracting Officer under paragraph C, E, or I hereof, except that if the Contractor has failed to submit his claim within the time provided in paragraph C or I hereof, and has failed to request extension of such time, he shall have no such right of appeal. In any case where the Contracting Officer has made a determination of the amount due under paragraph C, E, or I hereof the Owner shall pay to the Contractor the following: (1) if there is no right of appeal hereunder or if no timely appeal has been taken, the amount so determined by the Contracting Officer, or (2) if an appeal has been taken, the amount finally determined on such appeal.

H. In arriving at the amount due the Contractor under this clause there shall be deducted (1) all unliquidated advance or other payments on account theretofore made to the Contractor, applicable to the terminated portion of this contract, (2) any claim which the Owner may have against the Contractor in connection with the contract, and (3) the agreed price for, or the proceeds of sale of any materials, supplies, or other things acquired by the Contractor or sold, pursuant to the provisions of this clause, and not otherwise recovered by or credited to the Owner.

I. If the termination hereunder be partial, the Contractor may file with the Contracting Officer a claim for an equitable adjustment of the price or prices specified in the contract relating to the continued portion of the contract (the portion not terminated by the Notice of Termination), and such equitable adjustment as may be agreed upon shall be made in such price or prices. Any claim by the Contractor for an equitable adjustment under this clause must be asserted within ninety (90) days from the effective date of the termination notice, unless an extension is granted in writing by the Contracting Officer.

J. The Owner may from time to time, under such terms and conditions as it may prescribe, make partial payments and payments on account against costs incurred by the Contractor in connection with the terminated portion of this contract whenever in the opinion of the Contracting Officer the aggregate of such payments shall be within the amount to which the Contractor will be entitled hereunder. If the total of such payments is in excess of the amount finally agreed or determined to be due under this clause, such excess shall be payable by the Contractor to the Owner upon demand, together with interest computed at the rate established by the Secretary of the Treasury pursuant to Public Law 92-41, 85 STAT 97 for the Renegotiation Board for the period from the date such excess payment is received by the Contractor to the date on which

such excess is repaid to the Owner; provided, however, that no interest shall be changed with respect to any such excess payment attributable to a reduction in the Contractor's claim by reason of retention or other disposition of termination inventory until ten days after the date of such retention or disposition, or such later date as determined by the Contracting Officer by reason of the circumstances.

K. Unless otherwise provided for in this contract, or by applicable statute, the Contractor shall--from the effective date of termination until the expiration of three years after final settlement under this contract-preserve and make available to the Owner at all reasonable times at the office of the Contractor but without direct charge to the Owner, all his books, records, documents and other evidence bearing on the costs and expenses of the Contractor under this contract and relating to the work terminated hereunder, or, to the extent approved by the Contracting Officer, photographs, microphotographs, or other authentic reproductions thereof.

78. USE OF UNITED STATES FLAG VESSELS

A. To use privately-owned United States flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo lines, and tankers) of any equipment, materials, or commodities that are both (1) procured, contracted for, or otherwise obtained with funds made available by State under this contract, and (2) transported by ocean vessel, to the extent such vessels are available at fair and reasonable rates;

B. To furnish within 20 working days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, "on-board" commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph A above to both State and to the Division of National Cargo, Office of Market Development, U.S. Maritime Administration, Washington, D.C. 20590; and,

C. Subject to existing contracts, to insert the substance of the provisions of this section in all contracts issued pursuant to this contract, and to cause such provisions to be inserted in all subcontracts issued pursuant to this contract, where the contract or subcontract is for \$100,000 or more and where there is a possibility of ocean transportation of procured equipment or materials.

79. DEBARMENT AND SUSPENSION

A. Contractor/Vendor shall not make any award or permit any award (subgrant or contract) at any tier to any party which is debarred or suspended or is otherwise excluded from or ineligible for participation in Federal assistance programs under Executive Order 12549, "Debarment and Suspension."

B. The Final Rule, Government-Wide Debarment and Suspension (Nonprocurement), issued by the Office of Management and Budget and the Department of Defense (32 CFR Part 25) to implement the provisions of Executive Order 12549, "Debarment and Suspension" is incorporated by reference and the Contractor/Vendor covenants and agrees to comply with all provisions thereof, including any amendments to the Final Rule that may hereafter be issued.

80. NONDISCRIMINATION

A. The Contractor/Vendor covenants and agrees that no person shall be denied benefits of, or otherwise be subjected to discrimination in connection with the Contractor/Vendor's performance under this MCA, on the ground of race, religion, color, national origin, sex or handicap. Accordingly and to the extent applicable, the Contractor/Vendor covenants and agrees to comply with the following:

(1) Title VII of the Civil Rights Act of 1964 (42 U.S.C. 2000d <u>et seq.</u>), and DOD Regulations (32 CFR Part 300) issued thereunder;

 Executive Order 11246 and Department of Labor Regulations issued thereunder (41 CFR Part 60);

(3) Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 794) and DOD Regulations issued thereunder (32 CFR Part 56); and,

(4) The Age Discrimination Act of 1975 (42 U.S.C. 6101 <u>et seq.</u>) and DOD Regulations issued thereunder (45 CFR Part 90).

81. LOBBYING

A. The Contractor/Vendor covenants and agrees that it will not expend any funds appropriated by Congress to pay any person for influencing or attempting to influence an officer or employee of any agency, or a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; and, the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

B. The Interim Final Rule, New Restrictions on Lobbying, issued by the Office of Management and Budget and the Department of Defense (32 CFR Part 28) to implement the provisions of Section 319 of Public Law 101-121 (31 U.S.C. 1352) is incorporated by reference.

82. DRUG-FREE WORK PLACE

A. The Contractor/Vendor covenants and agrees that it will comply with the provisions of the Drug-Free Work Place Act of 1988 (Public Law 100-690, Title V, Subtitle D; 41 U.S.C. 701 <u>et seq.</u>) and maintain a drug-free workplace.

B. The Final Rule, Government-Wide Requirements for Drug-Free Workplace (Grants), issued by the Office of Management and Budget and the Department of Defense (32 CFR Part 28, Subpart f) to implement the provisions of the Drug-Free Work Place Act of 1988 is incorporated by reference and the Contractor/Vendor covenants and agrees to comply with all the provisions thereof, including any amendments to the Final Rule that may hereafter be issued.

83. ENVIRONMENTAL STANDARDS

A. The Contractor/Vendor agrees that its performance under this contract shall comply with: the requirements of Section 114 of the Clean Air Act (42 U.S.C. § 7414) and Section 308 of the Federal Water Pollution Control Act (33 U.S.C. § 1318), that relate generally to inspection, monitoring, entry reports, and information, and with all regulations and guidelines issued thereunder; the Resources Conservation and Recovery Act (RCRA); the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA); the National Environmental Policy Act (NEPA); and any applicable Federal, Contractor/Vendor or Local environmental regulation.

B. The Contractor/Vendor shall insure that no facility used in its performance under this contract is listed on the Environmental Protection Agency (EPA) list of violating facilities pursuant to 40 CFR Part 15 without the concurrence of State. The Contractor/Vendor shall notify State of the receipt of any communication from EPA indicating that a facility to be or being used in its performance under this contract is under consideration for listing on the EPA list of violating facilities.

C. For the purposes of this section, State agrees that the Contractor/Vendor's obligations in Paragraphs a. and b. of this section above shall not apply to any armory, base, training site, or other facility or portion thereof, the operation and maintenance of which is funded under this contract, that is currently listed as a violating facility, on the effective date of this contract, pursuant to 40 CFR Part 15; nor, shall such listing be the basis for State's termination for cause of this contract or for State's disallowance of any cost otherwise allowable under this contract. The Contractor/Vendor and State agree to cooperate to remediate, as expeditiously as possible, for any facility the operation and maintenance of which is within the scope of this contract, the condition giving rise to the listing of any such facility as a violating facility according to applicable statutes, regulations, or other agreements subject to the availability of funds.

84. NATIONAL HISTORIC PRESERVATION

Any construction, acquisition, modernization, or other activity that may impact a historic property.

A. The Contractor/Vendor agree to identify to the awarding agency any property listed or eligible for listing on the National Register of Historic Places that will be affected by this award, and to provide any help the awarding agency may need, with respect to this award, to comply with Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470, et seq.), as implemented by the Advisory Council on Historic Preservation regulations at 36 CFR Part 800 and Executive Order 11593 (3 CFR, 1971-1975 Comp., p. 559).

36 CFR Part 800 requires Grants Officers to get comments from the Advisory Council on Historic Preservation before proceeding with Federally assisted projects that may affect properties listed on or eligible for listing on the National Register of Historic Places.

85. HATCH ACT

A. The Contractor/Vendor agrees to comply with the Hatch Act (5 U.S.C. 1501 - 1508 and 7324 - 7328), as implemented by the Office of Personnel Management at 5 CFR Part 151, which limits political activity of employees or officers of State or local governments whose employment is connected to an activity financed in whole or part with Federal funds.

86. CARGO PREFERENCE

Any agreement under which international air travel may be supported by U.S. Government funds.

A. Travel supported by U.S. Government funds under this agreement shall use U.S.-flag air carriers (air carriers holding certificates under 49 U.S.C. 41102) for international air transportation of people and property to the extent that such service is available, in accordance with the International Air Transportation Fair Competitive Practices Act of 1974 (49 U.S.C. 40118) and the interpretative guidelines issued by the Comptroller General of the United States in the March 31, 1981, amendment to Comptroller General Decision B138942.

87. RELOCATION AND REAL PROPERTY ACQUISITION

A. The Contractor/Vendor agrees that it will comply with the provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. § 4601 <u>et seq.</u>) and regulations issued thereunder (49 CFR Part 24).

88. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

A. The Contractor/Vendor agrees that it will comply with Sections 103 and 107 of the Contract Work Hours and Safety Standards (40 U.S.C. 327-330) as supplemented by Department of Labor regulations (29 CFR Part 5). As applied to this agreement, the Contract Work Hours and Safety Standards Act specifies that no laborer or mechanic doing any part of the work contemplated by this agreement shall be required or permitted to work more than 40 hours in any workweek unless paid for all additional hours at not less than 1 1/2 times the basic rate of pay. This Act is applicable to any construction contract awarded in excess of \$2,000, and in excess of \$2,500 for other contracts which involve the employment of mechanics or laborers.

89. DAVIS-BACON ACT

When required by Federal assistance program legislation, such as the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, environmental remediation construction, the following provision applies.

A. The Contractor/Vendor agrees that it will comply with the Davis-Bacon Act (40 U.S.C. 276a to a-7) as supplemented by U.S. Department of Labor regulations (29 CFR Part 5). All rulings and interpretations of the Davis-Bacon Acts contained in 29 CFR Part 5 are incorporated by reference in this agreement. As applied to this agreement, the Davis-Bacon Act (40 U.S.C. 276a-276a-7) provides that contracts in excess of \$2,000 to which the Federal Government provides assistance funding for construction, alteration, or repair (including painting and decorating) of public buildings or public works within the United States, shall contain a provision that no laborer or mechanic employed directly upon the site of the work shall receive less than the prevailing wage rates as determined by the U.S. Secretary of Labor.

90. STATE ADDENDUM

A. "It is agreed that the terms and commitments contained herein shall not constitute a debt of The State of Alabama in violation of Article II, Section 213 of the Constitution of Alabama, 1901, as amended by Amendment 26. It is further agreed that if any provision of this contract shall contravene any statue, constitutional provision or amendment to the Constitution, now in effect or which may, during the course of this contract be enacted. Then that conflicting provision in the contract shall be deemed null and void."

B. "The Contractor's sole remedy for settlement or any and all disputes arising under the Terms of this agreement shall be limited to filing a claim with The Board of Adjustment for the State of Alabama."

C. "In event of proration of the fund from which payment under this contract is to be made; the contract will be subject to termination."

D. "The Contractor acknowledges and understands this contract is not effective until it has received all requisite state government approvals and the Contractor shall not begin performance until notified to do so by State Property & Disbursing Office. The Contractor shall not be entitled to compensation for work performed prior to effective date of contract."

SECTION 00 73 00 - SPECIAL CONDITIONS OF THE CONTRACT

The following special conditions modify, change, delete, or add to the "General Conditions of the Contract", (June 2009) Section 00 72 00. Where any Article, Paragraph, or Clause of the General Conditions is modified or deleted by the Special Conditions, the unaltered provisions of that Article, Paragraph, or Clause remain in effect. These Special Conditions shall take precedence over and modify all other specification provisions to the extent in which there may be any conflict.

PARAGRAPH 2. DEFINITIONS, INTENT, CORRELATION, AND STREAMLINING

2.C(1) Modify the "Order of Precedence" as follows:

- (a) The Contract Agreement
- (b) Addenda, with those of later date having precedence over those of earlier date.
- (c) Special Conditions (or other Conditions which modify the General Conditions of the Contract).
- (d) General Conditions of the Contract
- (e) The Detailed Specification Requirements

(f) Details appearing on the Drawings; large scale details shall take precedence over smaller scale details.

(g) The Working Drawings; large scale drawings shall take precedence over smaller scale drawings.

2.C(5) Add the following:

In the case of inconsistency between Drawings and Specifications or within either document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.

PARAGRAPH 14. PROTECTION OF WORK AND PROPERTY

Add the following:

This project location/site is normally used as a U.S. Military facility.

If U. S. Military personnel are remaining in tenancy, the Contractor shall be required, for the duration of the project, to maintain the level of security that exists at the project site at the Notice to Proceed date. The Contractor shall make certain that at the end of each workday all doors, windows, walls penetrations, fencing, etc. is completely secured to prevent intruders, etc. In the event that the facility cannot be secured via Owner approved: locks, temporary partitions, etc. then the Contractor shall provide at his expense, a qualified security guard (pre-approved in writing by the Owner) to protect the site or building. Failure to maintain the security of the facility can be considered grounds for dismissal from the project.

For facilities where U. S. Military personnel are remaining in tenancy, the general operating hours of this facility are approximately 7:00 a.m. to 5:30 p.m. Tuesday - Friday. In the event that the Contractor must conduct work outside of the typical operating hours of the facility the Contractor must notify and request in writing to the Owner and Architect a minimum of five days prior to the time that Contractor desires to work. The Contractor shall not work outside typical operating hours unless it is approved, in writing, by the Owner.

The provisions in the previous two paragraphs can be modified by the Owner. These provisions may also be modified by Addenda.

The Contractor shall not permit a load to be applied, or forces introduced, to any part of the existing or new construction or site that may cause damage to the construction or site or endanger safety of the construction, site, or persons on or near the site.

PARAGRAPH 19. CHANGES IN THE WORK

Modify per the following:

A. By mutually agreed price or prices which will be added to or deducted from the Contract Price. Additions to the contract price shall include the Contractor's overhead and profit but shall not exceed 15 percent. Where subcontract work is involved, the total mark-up for the Contractor and subcontractors shall not exceed 25%. This percentage allowance for overhead and profit shall include the cost of superintendent, timekeeper, clerks, watchmen, use of small tools, incidental job burdens, and general office expenses. There will be no additional or separate charges for these items. No allowance for overhead and profit shall be figured on any change which involves a net credit to the Owner. Changes which involve a net credit to the Owner shall include credits for overhead and profit on the deducted work.

PARAGRAPH 28. APPLICATIONS FOR PARTIAL AND FINAL PAYMENTS

Add the following:

Unless otherwise provided in the Contract Documents, the Contractor's cost of materials and equipment to be incorporated into the Work, which are stored off site, may also be considered in Partial Applications for Payment under the following conditions:

(1) the contractor has received written approval from the Owner to store the materials or equipment off site in advance of delivering materials to the off-site location;

(2) a Certificate of Insurance is furnished to, and accepted by, the Owner evidencing that a special insurance policy, or rider to an existing policy, has been obtained by the Contractor providing all-risk property insurance coverage, specifically naming the materials or equipment stored and naming the Owner as an additionally insured party;

(3) the Architect is provided with a detailed inventory of stored materials or equipment and the materials or equipment are clearly marked in correlation to the inventory to facilitate inspection and verification of the presence of the materials or equipment by the Architect or Owner;

(4) the materials or equipment are properly and safely stored in a bonded warehouse, or a facility otherwise approved in advance by the Owner; and

(5) compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest.

FINAL ACCEPTANCE of the WORK

Final Completion or Final Acceptance of the Work shall be achieved when all work including all "punch list" items recorded have been fully completed or corrected and accepted by the Owner and Architect.

PREREQUISITES to FINAL PAYMENT

The following conditions are prerequisites to Final Payment becoming due to the Contractor:

(1) Full execution of the Certificate of Final Completion for the Work.

(2) The Contractor's completion, to the satisfaction of the Architect and Owner, of all documentary requirements identified in sections 01 77 00 - Project Closeout and 01 78 13 Project Closeout Checklist.

PARAGRAPH 89. DAVIS BACON ACT

Delete this paragraph in its entirety.

ADD THE FOLLOWING PARAGRAPH:

PARAGRAPH 91. ADDITIONAL GENERAL CONTRACTOR ONE YEAR WARRANTY ITEMS

1. The General Contractor is required to provide the Manufacturer's recommended preventative maintenance, including inspections, for ALL items installed or refurbished in this project for a period of ONE year from the date of final acceptance.

2. The General Contractor will perform the preventative maintenance and inspections per Manufacturer's recommended intervals for each item.

3. The General Contractor will provide the Owner written documentation that the required preventative maintenance and inspections have been performed. This documentation will be provided at each Manufacturer's recommended interval and verified by the owner or tenant of each facility.

END OF SECTION

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Northport FMS#9 Renovations Northport, AL SECTION 01 10 00 - SUMMARY OF WORK

(Revision Date: 17 August 2021)

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work in this section.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Project consists of work as described in the drawings and specifications entitled: Northport FMS #9 Renovations prepared by Seav Seav & Litchfield, P.C., dated January 2022.
- B. The types of work specified in this section include the following:
 - Furnishing of all labor, materials, tools, equipment, staging areas, hoisting, qualified personnel and proper supervision for the work described in the drawings and specifications.
 - 2. Protection of the buildings, grounds, building personnel and visitors.
- C. Work to be performed under a single prime contract.

1.03 WORK UNDER OTHER CONTRACTS

- A. The Owner may at times have other work in progress at the site.
- B. Contractor shall cooperate fully with separate contractors (if any) so that work under those contracts may be carried out smoothly, without interfering with or delaying work under either contract.

1.04 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall have access to all areas of the building where work is to be undertaken.
- B. OWNER OCCUPANCY 1. Reference Section 00 73 00 – Special Conditions of the Contract, Paragraph 14.

1.05 JOB CONDITIONS

- A. Coordinate all work under this contract with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of the work and protection of materials and finishes.
- B. The Contractor is responsible for the water tightness of the Existing Building during the construction contract period (after work of this contract begins). In the event the

Contractor fails to maintain buildings in a watertight condition, the Contractor shall be responsible for any damage caused to the Owner's property.

- C. In the event emergency action must be taken by the Owner's maintenance forces to protect property, due to the Contractor's failure to maintain buildings in a watertight condition, the Contractor shall be responsible for all of the Owners' labor and materials cost incurred due to emergency action and he shall reimburse the Owner for such cost by standard Change Order procedure.
- D. Work under this contract must be completed in a continuous fashion. If the Contract Documents show phased work, the phasing plan must be followed, unless the Contractor has requested, and received, written approval from the Owner to deviate from the phasing plan shown in the Contract Documents.

E. CONTRACTOR USE OF SITE AND PREMISES

- 1. Provide access to and from site as required by law and by Owner:
 - a. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - b. Do not obstruct roadways, sidewalks, or other public ways without permit.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WORK SEQUENCE

- A. The Notice to Proceed (NTP) is <u>14</u> calendar days from the email delivery of the fully executed contract to the Contractor, unless otherwise agreed upon, in writing, by the Owner and the Contractor.
- B. Contract Time begins at the NTP.
- C. Perform all work in not to exceed **410 Calendar Days** in accordance with the following (calculated as the sum of 3.01.C.1 through 3.01.C.2. [inclusive]):
 - The Contractor has <u>365</u> calendar days to perform all Work, including but not limited to the following: providing all required operator training, the "Punch-List Inspection", correcting all deficiencies noted in the "Punch-List Inspection", and successful completion of the Final Inspection – with no noted deficiencies.
 - The Contractor has <u>45</u> days, from 3.01.C.1. (above), to have submitted a complete Project Closeout package, as detailed and defined in Sections 01 77 00 and 01 78 13.

3.02 LIQUIDATED DAMAGES

- A. If final completion is not achieved within the time for contraction noted above, liquidated damages will be assessed in the amount of 6% per annum.
- B. The liquidated damages assessed will be deducted from the final pay application prior to payment by the Owner.

END OF SECTION

SUMMARY OF WORK

Northport FMS#9 SS& Renovations Northport, AL SECTION 01 23 00 – ALTERNATES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Administrative and procedural requirements for Additive Alternates.

1.02 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.03 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 SCHEDULE OF ALTERNATES

A. Bid Item A: All work as indicated as part of the FMS #9, New Storage Building, New Wash Rack and all associated site work except for the installation of the wash rack cover. All work associated with the installation of the wash rack cover excluding all

Northport FMS#9 Renovations Northport, AL

concrete footings and wash rack concrete paving installation shall be considered part of the Alternate Bid Items listed Below:

a. Alternate Bid Item A-1: Installation of wash rack cover. Includes all plant, labor, and material for the installation of steel framing, standing seam metal roof panels and trim, and electrical work necessary for wash rack lighting (conduit, circuits, fixtures and accessories). All concrete work, including but not limited to footings, foundations, and wash rack paving shall be considered part of Bid Item A.

END OF SECTION

Northport FMS#9 Renovations Northport, AL SECTION 01 25 13 - PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL:

1.01 SUMMARY

- A. Section Includes: Administrative and procedural requirements for handling requests for substitutions made AFTER award of the Contract.
- B. Related Sections:
 - 1. 00 43 25 - Substitution Request Form During Bidding.
 - 2. 00 72 00 - General Conditions of the Contract
 - 3. 01 25 14 Substitution Request Form During Construction.
 - 4. 01 33 00 Submittal Procedures

1.02 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.03 SUBMITTALS

- A. Substitution Request Form: Submit all substitution requests using the form provided in this Project Manual. Use Section 01 25 14 - Substitution Request Form During Construction.
 - 1. Product substitutions will NOT be considered after award of the Contract unless the above substitution form is used.
 - 2. Architect will reject incomplete forms.
- B. Substitution Requests: Submit three (3) copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number(s), Specification Section title(s), Drawing number(s), and Drawing title(s).
 - 1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - Statement indicating why specified material or product cannot be provided. a.
 - Coordination information, including a list of changes or modifications needed b. to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - Detailed comparison of significant qualities of proposed substitution with C. those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - Samples, where applicable or requested. e.
 - List of similar installations for completed projects with project names and f. addresses and names and addresses of architects and owners.

Northport FMS#9 Renovations Northport, AL

- g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
- h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to the Owner.
- i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
- j. Cost information, including a proposal of change, if any, in the Contract Sum.
- Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
- Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution.

PART 2 – PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

- A. Timing: Architect will consider requests for substitution if received within twenty (20) days after Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
- B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - 2. Requested substitution does not require extensive revisions to the Contract Documents.
 - 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 4. Substitution request is fully documented and properly submitted.
 - 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
 - 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 7. Requested substitution is compatible with other portions of the Work.

Northport FMS#9 Renovations Northport, AL

- 8. Requested substitution has been coordinated with other portions of the Work.
- 9. Requested substitution provides specified warranty.
- 10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

C. Exceptions: The following are not considered substitutions and are not subject to requirements specified in this Section:

- 1. Substitutions requested during the Bidding period, and accepted via Addenda.
- 2. Revisions to Contract Documents requested by the Owner.
- 3. Specified options on products and construction methods included in Contract Documents.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

Northport FMS#9 Renovations Northport, AL	SS&L Job	No.: 14057	January 2022
SECTION 01 25 14 - SUBSTITU	JTION REQUEST FO		UCTION
(Revision Date: 14 Jan 2021)			
			ON DECUISET AFTER
AWARD OF CONTRACT. OTH	IER FORMS OF SUI	STITUTION REQUEST	IS WILL NOT BE
Project: Northport FMS#9 Re	novations S	ubstitution Request N	umber:
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Architect: Seay Seay and Lite	hfield, P.C.		
1115 South Court Street			
Montgomery, AL 36104			
From:		_	
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Similar Insta	Illation:						
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Drawings	Product Data	Samples	Tests	Re	ports		

Northport FMS#9	
Renovations	
Northport, AL	
The Undersigned Cert	tifi

The Undersigned Certifies:	
Proposed substitution has be respects to specified product. specified product. Same main available. Proposed substitute delay progress schedule. Cos related to accepted substitution substitution does not affect d changes to building design, in substitution. Coordination, in substitution will be complete	a fully investigated and determined to be equal or superior in all Same warranty will be furnished for proposed substitution as for enance service and source of replacement parts, as applicable, is in will have no adverse effect on other trades and will not affect or data as stated above is complete. Claims for additional costs which may subsequently become apparent are waived. Proposed bensions and functional clearances. Payment will be made for luding A/E design, detailing, and construction costs caused by the tallation, and changes in the Work as necessary for accepted of the Contractor in all respects.
Submitted By:	Signed By:
Firm:	
Address:	
Telephone:	Fax:
E-mail:	Website:
Attachments:	
A/E's REVIEW AND ACTION (t Substitution recommended fo Substitution recommended fo	is section to be completed by Architect/Engineer) Acceptance by the Owner (Strikethrough if NOT applicable) Rejection by the Owner (Strikethrough if NOT applicable)

Signed By: _____ Date: _____

OWNER'S REVIEW AND ACTION (this section to be completed by Owner's KO/COR)

Substitution Accepted by the Owner (Strikethrough if NOT applicable) Substitution Rejected by the Owner (Strikethrough if NOT applicable)

Signed	By:	_
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Date: _____

END OF SECTION

SUBSTITUTION REQUEST FORM DURING CONSTRUCTION

Northport FMS#9 Renovations Northport, AL SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
 - Specification 00 72 00 General Conditions of the Contract, Specification 00 73 00 1. Special Conditions of the Contract and Specification 01 26 14 Change Order Recap Form.

1.03 MINOR CHANGES IN THE WORK

A. All changes in the Work will only be authorized by a fully executed Contract Modification Form, executed by both the Contractor and the Owner, or as otherwise authorized by the General Conditions of the Contract.

1.04 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Owner will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - Proposal Requests issued by Owner are for information only. Do not consider 1. them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change. The submission shall include:
 - a. A list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indication of applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Costs of labor directly attributable to the change.
 - d. An updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Other requirements of the General Conditions of the Contract.
 - Change Order Request Recap Form (01 26 14) completed by the Contractor. f.
 - g. Submission will be made as one complete packet, via electronic mail, to the Architect.

- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time. The submission shall include:
 - a. A list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indication of applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Costs of labor directly attributable to the change.
 - d. An updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Other requirements of the General Conditions of the Contract.
 - f. Change Order Request Recap Form (01 26 14) completed by the Contractor.
 - g. Submission will be made as one complete packet, via electronic mail, to the Architect.
- B. Proposal Request Form: Request for Proposal will be on Owner's approved form.

1.05 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, the Owner will issue a Contract Modification for signatures of Owner, Surety and Contractor on Owner's "Contract Modification / Supplemental Agreement Form".

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 26 14 CHANGE ORDER RECAP FORM

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SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
 - 1. Section 01 31 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.
 - 3. Section 00 62 76 "Contractor's Periodical Request for Partial Payment"

1.03 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.04 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with Continuation Sheets.
 - b. Submittals Schedule.
 - c. Contractor's Construction Schedule.
 - Submit the Schedule of Values to Architect in accordance with the requirements of the requirements of the Addenda and concurrent with both the initial Contractor's Draw Schedule (Section 00 62 83) and Contractor's Progress Schedule (Section 01 32 00).
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
 - 1. Identification: Utilize the Contractor's Periodical Request for Partial Payment form at Specification 00 62 83 for the Schedule of Values.
 - 2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the

Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate or as directed by the Owner.

- 3. To the greatest extent possible, round amounts to nearest whole dollar; total shall equal the Contract sum.
- 4. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site per 00 62 78.
- 5. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- 6. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by the allowance quantity. Use information indicated in the Contract Documents to determine quantities.
- 7. Alternates: Provide a separate line item in the Schedule of Values for each alternate.
- 8. There shall be a separate line in the amount of 2.5% of the Contract, as awarded, included on the Schedule of Values and titled "Closeout Documents"
- 9. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

1.05 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as checked by Architect and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Completion, and Final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Forms: Use Owner provided "Contractor's Periodical Request for Partial Payment" and Continuation Sheets as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. NOTE: If the Application is not signed by the person who submitted the Bid, the Architect and/or Owner reserve the right to reject the Application, unless and until the Contractor shall have provided the Owner a letter authorizing additional signatories, on Contractor's letterhead, and that Owner has accepted. Architect will return incomplete applications without action.

- 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
- 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit three, signed in blue ink and notarized, original copies of each Application for Payment to Architect at the next Owner-Architect-Contractor (OAC) meeting. Include waivers of lien and similar attachments as required.

- 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- F. Initial Application for Payment: Administrative actions and submittals, to include Owner's acceptance, that must precede submittal of first Application for Payment include the following:
 - 1. List of subcontractors.
 - 2. Schedule of Values.
 - 3. Contractor's Construction Schedule.
 - 4. Submittals Schedule (preliminary if not final).
 - 5. List of Contractor's principal consultants.
 - 6. Initial settlement survey and damage report if required.
- G. Periodic Applications for Payment: Administrative actions and submittals that must coincide with submittal of each Application for Payment include the following:
 - 1. Contractor's Periodical Request for Partial Payment.
 - 2. Submittals Schedule (updated).
 - 3. Inventory of Stored Materials submitted on form provided in Specification Section 00 62 78.
 - 4. Contractor's Draw Schedule on form provided in Specification Section 00 62 83.
 - Weather Delay Documentation Form as provided in Specification Section 00 63 56.
 - 6. Updated LEED Scorecard (if Applicable)
- H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation showing 100 percent completion for portion of the Work claimed as complete, including, but not limited, to the following:
 - 1. Evidence of completion of Project closeout requirements.
 - 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 - 3. Updated final statement, accounting for final changes to the Contract Sum.
 - 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 - 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 - 6. AIA Document G707, "Consent of Surety to Final Payment."
 - 7. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Final Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 - 8. Final, liquidated damages settlement statement.

Northport FMS#9 S Renovations Northport, AL PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 00 - PROJECT MANGEMENT AND COORDINATION

(Revision Date: 8 April 2021)

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes: Administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination Drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Project meetings.
- B. Related Sections:
 - 1. Section 01 32 00 Construction Progress Documentation: Preparing and submitting Contractor's Construction Schedule.
 - Section 01 73 00 Execution: Procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 01 77 00 Closeout Procedures: Coordinating Contract closeout.
 - 4. Section 01 91 13 General Commissioning Requirements: Meetings.

1.02 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - Coordinate installation of different components to assure manufacturers and applicable code(s) [whichever is greater] accessibility for required maintenance, service, and repair.
 - 3. Make provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 - 1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.

- 4. Delivery and processing of submittals.
- 5. Progress meetings.
- 6. Pre-installation conferences.
- 7. Project closeout activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.03 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
 - 1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil/site, mechanical, plumbing, and electrical systems.
 - b. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
 - 2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
 - 3. Number of Copies: Submit two opaque copies of each submittal. Architect will return one copy.
 - 4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.
- B. Staff Names: Within 15 days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
 - 1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

1.04 PROJECT MEETINGS

- A. General: Architect will schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
 - 1. Attendees: Architect will inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Architect will notify Owner and Contractor of scheduled meeting dates and times.
 - 2. Agenda: Architect will prepare and distribute the meeting agenda to all invited attendees.

- a. Architect shall provide Contractor and Owner with agenda items 48 hours before the Project Meeting.
- 3. Minutes: Architect will record significant discussions and agreements achieved. Meeting minutes will be distributed to everyone concerned, including Owner and Contractor, within three (3) days of the meeting.

B. Preconstruction Conference: Owner will schedule a preconstruction conference before starting construction, at a time convenient to Architect and Contractor, after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

- Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
- 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing Change Order Requests and Contract Modifications.
 - f. Procedures for requests for information (RFIs) utilizing the form in Section 01 26 20.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. LEED requirements (if applicable).
 - 1. Preparation of Record Documents.
 - m. Use of the premises and existing building(s).
 - n. Work restrictions.
 - o. Owner's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Construction waste management and recycling.
 - r. Parking availability.
 - s. Office, work, and storage areas.
 - t. Equipment deliveries and priorities.
 - u. First aid.
 - v. Security.
 - w. Progress cleaning.
 - x. Working hours.
- 3. Minutes: Architect will record and distribute meeting minutes.
- C. Commissioning Meetings: All Commissioning Meetings will be held and conducted in accordance with Section 01 91 13, Part 3.

1. Attendees: The mandatory attendees are the entire commissioning team, Owner, Contractor, affected sub-contractors, Architect and Architect's Consultants for items being commissioned.

2. Agenda: The Commissioning Agent (CxA) will provide all attendees with an agenda.

3. Reporting: CxA will take minutes and distribute to the Architect (for further distribution to Architect's Consultant), Owner and Contractor (for further distribution to Contractor's sub-contractor).

- D. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.
 - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. The Contract Documents.
 - b. Options.
 - c. Related requests for interpretations (RFIs).
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility problems.
 - k. Time schedules.
 - I. Weather limitations.
 - m. Manufacturer's written recommendations.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 - Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- E. Progress Meetings: Conduct progress meetings at regular intervals (at least monthly) scheduled with the Owner and Architect, otherwise known as Owner-Architect-
Contractor (OAC) meetings. Coordinate dates of meetings with preparation of payment requests.

- 1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
- Agenda: Review minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) Requests for information (RFIs).
 - 16) Status of proposal requests.
 - 17) Pending Change Order Requests.
 - 18) Status of Contract Modifications.
 - 19) Pending claims and disputes.
 - 20) Review of executed Periodical Requests for Partial Payments.
- 3. Minutes: Contractor will record the meeting minutes.
- 4. Reporting: Not later than 3 days after each meeting, distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
 - a. Schedule Updating: Update Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

Northport FMS#9 S Renovations Northport, AL PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes: Administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's Construction Schedule.
 - 2. Submittals Schedule.
 - 3. Daily construction reports.
 - 4. Field condition reports.
- B. Related Sections:
 - 1. Section 012900 Payment Procedures: Submitting the Schedule of Values.
 - 2. Section 013100 Project Management and Coordination: Submitting and distributing meeting and conference minutes.
 - 3. Section 013300 Submittal Procedures: Submitting schedules and reports.
 - 4. Section 014000 Quality Assurance: Submitting a schedule of tests and inspections.

1.02 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Fragment: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- C. Major Area: A story of construction, a separate building, or a similar significant construction element.

1.03 SUBMITTALS

- A. Submittals Schedule: Submit three (3) copies of schedule. Arrange the following information in a tabular format:
 - 1. Scheduled date for first submittal.
 - 2. Specification Section number and title.
 - 3. Submittal category (action or informational).
 - 4. Name of subcontractor.
 - 5. Description of the Work covered.
 - 6. Scheduled date for Architect's final release or approval.

B. Field Condition Reports: Submit two (2) copies at time of discovery of differing conditions.

1.04 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values (01 29 00) and Contractors Draw Schedule (00 62 83), list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from parties involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 – PRODUCTS

2.01 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
 - 1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
 - 2. Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the NTP to date of Final Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Owner.
 - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 - Submittal Procedures in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
 - 4. Startup and Testing Time: Include not less than three (3) days for startup and testing.

- 5. Project Completion: Indicate completion in advance of date established for Project Completion, and allow time for Architect's administrative procedures necessary for certification of Project Completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 3. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Final Acceptance.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 - 4. Work Stages: Indicate important stages of construction for each major portion of the Work.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Punch List Inspection, and Final Inspection.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragments to demonstrate the effect of the proposed change on the overall project schedule.

2.03 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format. Submit two
 (2) opaque copies of initial schedule, large enough to show entire schedule for entire construction period.
- B. CPM Schedule: Submit Contractor's Construction Schedule, simultaneously with the Schedule of Values (01 29 00) and the Draw Schedule (00 62 83), using a computerized, time-scaled CPM network analysis diagram for the Work in accordance with General Conditions, Article 9.
 - 1. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Owner's approval of the schedule.
 - 2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 3. Use "one workday" as the unit of time. Include list of nonworking days and holidays incorporated into the schedule.

- C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and commissioning.
 - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 - 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 - 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- D. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:
 - 1. Contractor or subcontractor and the Work or activity.
 - 2. Description of activity.
 - 3. Principal events of activity.
 - 4. Immediate preceding and succeeding activities.
 - 5. Early and late start dates.
 - 6. Early and late finish dates.
 - 7. Activity duration in workdays.
 - 8. Total float or slack time.
 - 9. Average size of workforce.
- E. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 - 1. Identification of activities that have changed.
 - 2. Changes in early and late start dates.
 - 3. Changes in early and late finish dates.
 - 4. Changes in activity durations in workdays.
 - 5. Changes in the critical path.
 - 6. Changes in total float or slack time.
 - 7. Changes in the Contract Time.

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. Equipment at Project site.
 - 3. Material deliveries.
 - 4. High and low temperatures and general weather conditions.
 - 5. Accidents.
 - 6. Stoppages, delays, shortages, and losses.
 - 7. Meter readings and similar recordings.
 - 8. Orders and requests of authorities having jurisdiction.
 - 9. Services connected and disconnected.
 - 10. Equipment or system tests and startups.
- B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

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SECTION 01 32 01 - PROJECT SCHEDULE

(Revised 3 August 2021)

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SECTION 01 32 01 - PROJECT SCHEDULE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1-1-11 (1995) Administration -- Progress, Schedules, and Network Analysis Systems

1.2 SUBMITTALS

Owner approval is required for submittals with an "Owner" Classification. Submittals not having an "Owner" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preliminary Project Schedule; Owner Initial Project Schedule; Owner Periodic Schedule Update;

1.3 PROJECT SCHEDULER QUALIFICATIONS

Designate an authorized representative to be responsible for the preparation of the schedule and all required updating and production of reports. The authorized representative must have a minimum of two years' experience scheduling construction projects similar in size and nature tothis project with scheduling software that meets the requirements of this specification. Representative must have a comprehensive knowledge of CPM scheduling principles and application.

PART 2 PRODUCTS

2.1 SOFTWARE

The scheduling software utilized to produce and update the schedules required herein must be capable of meeting all requirements of this specification.

2.1.1 Owner's Default Software

The Owner does not currently use a scheduling software.

2.1.2 Contractor Software

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Scheduling software used by the contractor must be commercially available.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Prepare for approval a Project Schedule, as specified herein. Show in the schedule the proposed sequence to perform the work and dates contemplated for starting and completing all schedule activities. The scheduling of the entire project is required. The scheduling of construction is the responsibility of the Contractor. Contractor management personnel must actively participate in its development. Subcontractors and suppliers working on the project must also contribute in developing and maintaining an accurate Project Schedule. Provide a schedule that is a forward planning as well as a project monitoring tool. Use the Critical Path Method (CPM) of network calculation to generate all Project Schedules. Prepare each Project Schedule using the Precedence Diagram Method (PDM).

3.2 PROJECT SCHEDULE DETAILED REQUIREMENTS

3.2.1 Level of Detail Required

Develop the Project Schedule to the appropriate level of detail to addressmajor milestones and to allow for satisfactory project planning and execution. Failure to develop the Project Schedule to an appropriate level of detail will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

3.2.2 Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities may have Original Durations (OD) greater than 20 work days or 30 calendar days.

3.2.3 Procurement Activities

Include activities associated with the critical submittals and their approvals, procurement, fabrication, and delivery of long lead materials, equipment, fabricated assemblies, and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days.

3.2.4 Mandatory Tasks

Include the following activities/tasks in the initial project schedule and all updates.

- a. Submission, review and acceptance of SD-01 Preconstruction Submittals (individual activity for each).
- b. Long procurement activities

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- c. Submission and approval of testing and air balance (TAB).
- d. Submission of TAB specialist design review report.
- e. Building commissioning Functional Performance Testing.
- f. Controls testing plan submission.
- g. Controls testing.
- h. Performance Verification testing.
- i. Other systems testing, if required.
- j. Contractor's punch list inspection.
- k. Correction of punch list from Contractor's punch list inspection.
- l. Owner's punch list inspection.
- m. Correction of punch list from Owner's punch list inspection.
- n. Final inspection.

3.2.5 Owner Activities

Show Owner and other agency activities that could impact progress. These activities include, but are not limited to: approvals, acceptance, environmental permit approvals by Alabama Department of Environmental Management (ADEM), inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

3.2.6 Standard Activity Coding Dictionary

Use an activity coding structure. Develop and assign all Activity Codes to activities as detailed herein.

3.2.6.1 Area of Work Coding (AREA)

Assign Work Area code to activities based upon the work area in which the activity occurs. Define work areas based on resource constraints or spaceconstraints that would preclude a resource, such as a particular trade or craft work crew from working in more than one work area at a time due to restraints on resources or space. Examples of Work Area Coding include different areas within a floor of a building, different floors within a building, and different buildings within a complex of buildings. Activities cannot have more than one Work Area Code.

Not all activities are required to be Work Area coded. A lack of Work Area coding indicates the activity is not resource or space constrained.

3.2.6.2 Modification Number (MODF)

Assign a Modification Number Code to any activity or sequence of activities added to the schedule as a result of a Contract Modification, when approved by Contracting Officer.

Key all Code values to the Owner's modification numbering system. An activity can have only one Modification Number Code.

3.2.6.3 Bid Item Coding (BIDI)

Assign a Bid Item Code to all activities using the Contract Line Item Schedule (CLIN) to which the activity belongs, even when an activity isnot cost loaded. An activity can have only one BIDI Code.

3.2.6.4 Phase of Work Coding (PHAS)

Assign Phase of Work Code to all activities. Examples of phase of work are procurement phase and construction phase. Each activity can have only one Phase of Work code.

- a. Code proposed fast track construction phases proposed to allow filtering and organizing the schedule by fast track construction packages.
- b. If the contract specifies phasing with separately defined performance periods, identify a Phase Code to allow filtering and organizing the schedule accordingly.
- 3.2.7 Contract Milestones and Constraints

Milestone activities are to be used for significant project events including, but not limited to, project phasing, project start and end activities, or interim completion dates. The use of artificial float constraints such as "zero free float" or "zero total float" are prohibited. Mandatory constraints that ignore or effect network logic are prohibited.No constrained dates are allowed in the schedule other than those specified herein. Submit additional constraints to the Contracting Officer for approval on a case by case basis.

3.2.7.1 Project Start Date Milestone and Constraint

The first activity in the project schedule must be a start milestone titled "NTP Issued," which must have a "Start On" constraint date equal to the date that the NTP is issued.

3.2.7.2 End Project Finish Milestone and Constraint

The last activity in the schedule must be a finish milestone titled "EndProject."

Constrain the project schedule to the Contract Completion Date in such a way that if the schedule calculates an early finish, then the float calculation for "End Project" milestone reflects positive float on the longest path. If the project schedule calculates a late finish, then the "End Project" milestone float calculation reflects negative float on the longest path. The Owner is under no obligation to accelerate Owner activities to support a

Contractor's early completion.

3.2.7.3 Interim Completion Dates and Constraints

Constrain contractually specified interim completion dates to show negative float when the calculated late finish date of the last activity in that phase is later than the specified interim completion date.

3.2.7.3.1 Start Phase

Use a start milestone as the first activity for a project phase. Call thestart milestone "Start Phase X" where "X" refers to the phase of work.

3.2.7.3.2 End Phase

Use a finish milestone as the last activity for a project phase. Call the finish milestone "End Phase X" where "X" refers to the phase of work.

3.2.8 Calendars

Schedule activities on a Calendar to which the activity logically belongs. Develop calendars to accommodate any contract defined work period such as a 7-day calendar for Owner Acceptance activities, concrete cure times, etc. Develop the default Calendar to match the

physical work plan with non-work periods identified including weekends and holidays. Develop Seasonal Calendar(s) and assign to seasonally affected activities as applicable.

3.2.9 Open Ended Logic

Only two open ended activities are allowed: the first activity "NTP Issued" may have no predecessor logic, and the last activity "End Project" may have no successor logic.

Predecessor open-ended logic may be allowed in a time impact analyses upon the Contracting Officer's approval.

3.2.10 Default Progress Data Disallowed

Actual Start and Finish dates must not automatically update with default mechanisms included in the scheduling software. Updating of the percent complete and the remaining duration of any activity must be independent functions. Disable program features that calculate one of these parameters from the other.

3.2.11 Out-of-Sequence Progress

Address out of sequence progress or logic changes in the periodic schedule update meetings.

3.2.12 Added and Deleted Activities

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Do not delete activities from the project schedule or add new activities to the schedule without approval from the Contracting Officer. Activity ID and description changes are considered new activities and cannot be changed without Contracting Officer approval.

3.2.13 Original Durations

Activity Original Durations (OD) must be reasonable to perform the work item. OD changes are prohibited unless justification is provided and approval is granted by the Owner.

3.2.14 Leads, Lags, and Start to Finish Relationships

Lags must be reasonable as determined by the Owner and not used in place of realistic original durations, must not be in place to artificially absorb float, or to replace proper schedule logic.

3.2.14.1	Leads (negative lags) are prohibited.
3.2.14.2	Start to Finish (SF) relationships are prohibited.

3.2.15 Retained Logic

Schedule calculations must retain the logic between predecessors and successors ("retained logic" mode) even when the successor activity(s) starts and the predecessor activity(s) has not finished (out-of-sequenceprogress). Software features that in effect sever the tie between predecessor and successor activities when the successor has started and the predecessor logic is not satisfied ("progress override") are not be allowed.

3.2.16 Percent Complete

Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be declared 100 percent complete to allow for proper schedule management. Percent complete must be updated no later than each OAC/Periodic Schedule Update meeting.

3.2.17 Remaining Duration

Update the remaining duration for each activity based on the number of estimated work days it will take to complete the activity. Remaining duration may not mathematically correlate with percentage found under paragraph entitled Percent Complete.

3.2.18 Cost Loading of Closeout Activities

Cost load the "Correction of punch list from Owner's punch list inspection" activity(ies) not less than 1 percent of the present contractvalue. Activity(ies) may be declared 100 percent complete upon the Owner's verification of completion and correction of all punch list work identified during Owner's punch list inspection(s) – i.e. upon issuance of a fully executed Certificate of Final Completion.

3.2.18.1 As-Built Drawings / O&M Manuals

Activity will be declared 100 percent complete upon the Owner's approval and acceptance of the as-built drawings which will happen no earlier than Owner's Final Inspection.

3.2.19 Early Completion Schedule and the Right to Finish Early

An Early Completion Schedule is an Initial Project Schedule (IPS) that indicates all scope of the required contract work will be completed before the contractually required completion date.

3.2.19.1 The Owner is under no obligation to accelerate work items the Owner is responsible for to ensure that the early completion is met nor is the Owner responsible to modify incremental funding (if applicable) for the project to meet the contractor's accelerated work.

3.3 PROJECT SCHEDULE SUBMISSIONS

Provide the submissions as described below. The data and CPM/GANTT Charts (submitted in Adobe via CD/DVD and in hard copy) required for each submission are contained in paragraph SUBMISSION REQUIREMENTS. If the Contractor fails or refuses to furnish the information and schedule updates as set forth herein, then the Contractor may be deemed not to have provided an estimate upon which a progress payment can be made.

Review comments made by the Owner on the schedule(s) do not relieve the Contractor from compliance with requirements of the Contract Documents.

3.3.1 Preliminary Project Schedule Submission

Within 14 calendar days after the Notice to Proceed (NTP) is issued submit the Preliminary Project Schedule defining the planned operations detailed for the first 90 calendar days for approval. The Preliminary Project Schedule may be summary in nature for the remaining performance period. It must be early start and late finish constrained and logically tied as specified. The Preliminary Project Schedule forms the basis for the Initial Project Schedule specified herein and must include all of the required plan and program preparations, submissions and approvals identified in the contract (for example, Quality Control Plan, Safety Plan, and Environmental Protection Plan) as well as, permitting activities and other non-construction activities intended to occur within the first 90 calendar days. Activity code any activities that are summary in nature after the first 90 calendar days with Bid Item (CLIN) code (BIDI).

3.3.2 Initial Project Schedule Submission

Submit the Initial Project Schedule for approval within 28 calendar days after notice to proceed is issued. The schedule must demonstrate a reasonable and realistic sequence of activities which represent all work through the entire contract performance period.

3.3.3 Periodic Schedule Updates

Update the Project Schedule on a regular basis, monthly at a minimum. Provide a Periodic Schedule Update for review at the schedule updatemeetings as prescribed in the paragraph PERIODIC SCHEDULE REVIEW MEETINGS. These updates will enable the Owner to assess Contractor'sprogress.

3.3.3.1 Update information including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD), and Percent Complete.

3.4 SUBMISSION REQUIREMENTS

Submit the following items for the Preliminary Schedule, Initial Schedule, and every Periodic Schedule Review meeting throughout the life of the project:

3.4.1 Data CD/DVDs

For the Preliminary and Initial Schedules, provide two sets of data CD/DVDs containing the current project schedule in Adobe format. Label each CD/DVD indicating the type of schedule (Preliminary or Initial), full contract number, Data Date and file name. Each schedule must have a unique file name and use project specific settings.

3.4.2 Hard Copies

Provide two hard copies for each of the Preliminary, Initial and Periodic Schedule Review meetings in CPM/GANTT chart form.

3.4.3 CPM/GANTT Chart

The CPM/GANTT Chart is required for the Preliminary, Initial and Periodic Schedule Review meetings. Depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.4.3.1 Continuous Flow

Show a continuous flow from left to right with no arrows from right to left. Show the activity number, description, and duration.

3.4.3.2 Project Milestone Dates

Show dates on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.4.3.3 Critical Path

Show all activities on the critical path. The critical path is defined as the longest path.

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3.4.3.4 Banding

Organize activities using the WBS or as otherwise directed to assist in the understanding of the activity sequence. Typically, this flow will group activities by major elements of work, category of work, work area and/or responsibility.

3.5 PERIODIC SCHEDULE UPDATE

3.5.1 Periodic Schedule Review Meetings/OAC

Conduct periodic schedule review meetings, concurrently with all OAC meetings, for the purpose of reviewing the proposed Periodic Schedule Update and progress payment. Conduct meetings at least monthly within five days of the proposed schedule data date. The Contractor's authorized scheduler must organize, group, sort, filter, perform schedule revisions as needed and review functions as requested by the Contractor and/or Owner. The meeting is a working interactive exchange which allows the Owner and Contractor the opportunity to review the updated scheduler must attend the meeting with the authorized representative of the Contracting Officer. The Superintendent, foremen and major subcontractors must attend the meeting as required to discuss the project schedule and work.

3.6 REQUESTS FOR TIME EXTENSIONS

Provide a justification of delay to the Contracting Officer in accordance with the contract provisions and clauses for approval within 10 days of a delay occurring. Also prepare a time impact analysis for each Owner request for proposal (RFP) to justify time extensions.

3.6.1 Justification of Delay

Provide a description of the event(s) that caused the delay and/or impact to the work. As part of the description, identify all schedule activities impacted. Provide a time impact analysis that demonstrates the effects of the delay or impact on the project completion date or interim completion date(s). Evaluate multiple impacts chronologically; each with its own justification of delay. With multiple impacts consider any concurrency of delay.

3.6.2 Time Impact Analysis (Prospective Analysis)

Prepare a time impact analysis for approval by the Contracting Officer based on the industry standard. Utilize a copy of the last approved schedule prior to the first day of the impact or delay for the time impact analysis. If Contracting Officer determines the time framebetween the last approved schedule and the first day of impact is too great, prepare an interim updated schedule to perform the time impact analysis. Unless approved by the Contracting Officer, no other changes may be incorporated into the schedule being used to justify the time impact.

3.6.3 Time Extension

The Contracting Officer must approve the Justification of Delay including the time impact analysis before a time extension will be granted. No time extension will be granted unless the delay consumes all available Project Float and extends the projected finish date ("End Project" milestone) beyond the Contract Completion Date. The time extension will be in calendar days.

Actual delays that are found to be caused by the Contractor's own actions, which result in a calculated schedule delay will not be a cause for an extension to the performance period, completion date, or any interim milestone date.

3.7 FAILURE TO ACHIEVE PROGRESS

Should the progress fall behind the approved project schedule for reasons other than those that are excusable within the terms of the contract, the Contracting Officer may require provision of a written recovery plan for approval. The plan must detail how progress will be made-up to include which activities will be accelerated by adding additional crews, longer work hours, extra work days, etc.

3.7.1 Artificially Improving Progress

Artificially improving progress by means such as, but not limited to, revising the schedule logic, modifying or adding constraints, shortening activity durations, or changing calendars in the project schedule is prohibited. Indicate assumptions made and the basis for any logic, constraint, duration and calendar changes used in the creation of the recovery plan. Any additional resources, manpower, or daily and weekly work hour changes proposed in the recovery plan must be evident at the work site and documented in the daily report.

3.7.2 Failure to Perform

Failure to perform work and maintain progress in accordance with the supplemental recovery plan may result in the full range of options available to the Contracting Officer; including, but not limited to, the Contractor being declared "non-responsible" and barred from bidding on future projects for a period of time, Liquidated Damages being imposed on the Contractor or early termination of the project.

3.8 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, may not be considered for the exclusive use of either the Owner or the Contractor including activity and/or project float. Activity float is the number of work days that an activity can be delayed without causing a delay to the "End Project" finish milestone. Project float (if applicable) is the number of work days between the projected early finish and the contract completion date milestone.

End of Section

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL:

1.01 SUMMARY

A. Shop Drawings and samples shall be properly identified by project name, description or names of equipment, materials, and items, and complete identification of locations at which materials or equipment are to be installed.

1.02 SHOP DRAWINGS

- A. Submit Shop Drawings for all items called for in the detail Specifications. Submit a minimum of six (6) black line prints of each Drawing, unless otherwise specified in the detail Specifications. Two prints of each Drawing will be retained by the Architect, the remaining prints will be returned to the Contractor. One print of each Drawing, bearing the final approval stamp of Architect, shall be kept at the project office and shall be maintained in good condition. No Shop Drawings other than those stamped "Approved" shall be on the job for any purpose and any work installed incorrectly from any Shop Drawing shall be removed and corrected at no change in contract price.
- B. Approval will be for general design only and will not relieve Contractor from responsibility for errors or omissions in Shop Drawings, even though same were not indicated when approved.
- C. In checking Shop Drawings, The Architect shall not be required to check dimensions, quantities, electrical characteristics, specific capacities, or coordination with other trades, these being the responsibility of the Contractor. Contractor shall attest, either in writing, by stamp, or signature, that all Shop Drawings submitted for approval have been checked for compliance with the Drawings and Specifications prior to submissions to the Architect otherwise they will be returned unchecked.
- D. No Shop Drawings shall be submitted directly to the Architect from a manufacturer, jobber, or sub-contractor. All submittals shall be through the General Contractor.
- E. Approvals shall not be construed as approved departure from Contract Drawings and Specifications.

1.03 SAMPLES

- A. Furnish all samples called for in the detail Specifications and such other samples as the Architect may direct.
- B. Samples or color selections shall include a complete selection of available colors and finishes. After Owner has selected colors and finishes, submit four additional samples of the selected colors and finishes which will become a master color guide to be used throughout the progress of the work.

1.04 SUBMISSION

- A. Submission of Shop Drawings and samples shall be by a transmittal letter, in duplicate, containing project name, Contractor's name, Sub-contractor's and/or Vendor's name, a complete listing of Drawings or Samples submitted, and other pertinent data.
- B. Samples of materials in connection with mechanical and electrical work may not be submitted to the Engineer. All samples of materials are to be submitted to the Architect.
- C. Samples for the selection of colors and finishes shall be made in one submittal. No color selections will be made until samples on all items requiring color selection have been submitted.

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Quality Control Requirements.
 - 2. Administrative and procedural requirements for quality assurance and quality control.
- B. Related Sections:
 - 1. Section 01 32 00 Construction Progress Documentation: Developing a schedule of required tests and inspections.
 - 2. Section 01 73 29 Cutting and Patching: Repair and restoration of construction disturbed by testing and inspecting activities.
 - 3. Divisions 02 through 50 Sections: Specific test and inspection requirements.

1.02 QUALITY CONTROL REQUIREMENTS

- A. General: The Contractor shall establish a system of inspections and tests of his work and that of his subcontractors to insure that all applicable requirements of the specifications are met.
 - 1. The Contractor shall be diligent to insure that the quality of workmanship is satisfactory, that dimensional requirements are met, that defective materials are not used and that all required control and laboratory testing procedures are effected.
 - 2. Where specific testing procedures are not stipulated, the Contractor shall establish and conduct a test procedure to insure adherence to specified quality.
 - 3. The Contractor shall make an initial inspection of each phase of work as soon as a representative portion has been completed, and the Contractor shall make daily follow-up inspections, to insure that an acceptable quality of work is established and maintained.
 - 4. The Contractor shall perform a pre-final inspection and work off all punch list items prior to Architect's or Owner's inspection(s).

1.03 DEFINITIONS

- A. Conventional Inspections: Inspections, not specifically required by Code, which are considered essential to the proper performance of the building systems.
- B. Inspections: Evaluation of systems, primarily requiring observation and engineering judgment.
- C. Quality-Control Services: Conventional inspections, special inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. Services do not include contract enforcement activities performed by Architect.

- D. Special Inspections: Inspections, required by Code, which monitor the quality of materials and workmanship critical to the structural integrity of the building.
- E. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- F. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
- G. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.
- H. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction and the Owner, to establish product performance and compliance with industry standards.
- J. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- K. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- L. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- M. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- M. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 QUALITY ASSURANCE AND CONTROL SERVICES REQUIREMENTS

- A. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
- B. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, the Contract Documents or authorities having jurisdiction are not limited by provisions of this Section.

1.05 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement, unless directed otherwise by the Owner. Refer uncertainties and requirements that are different, but apparently equal, to the Architect, in writing, for the Owner's decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect, in writing, for the Owner's decision before proceeding.

1.06 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.

- 8. Complete test or inspection data.
- 9. Test and inspection results and an interpretation of test results.
- 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
- 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
- 12. Name and signature of laboratory inspector.
- 13. Recommendations on retesting and re-inspecting.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.07 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

G. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

- 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
- 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
- 3. Demonstrate the proposed range of aesthetic effects and workmanship.
- 4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
- 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
- 6. Demolish and remove mockups when directed, unless otherwise indicated.

1.08 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - 2. Payment for these services will be made from allowances, as authorized by the Owner.
 - 3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Modification.
- B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction, at no additional expense to the Owner or Architect. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 1. Where services are not indicated as Owner's responsibility, engage a qualified testing agency to perform these quality-control services.
 - 2. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - 3. Notify testing agencies and Architect at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 - 4. For all quality-control services that are not indicated as Owner's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 - Submittal Procedures.
- D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

- 1. Notify Architect, Owner, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
- 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
- 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
- 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
- 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
- 6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required qualityassurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.09 STANDARD AND INDUSTRY SPECIFICATIONS

A. Any material or operation specified by reference to the published specification of a manufacturer, The American Society for Testing and Materials (ASTM), The American Standards Association (ASA), Federal Specifications, or other published standard shall comply with the requirements of the current specification or standard listed. Should there be a discrepancy between the referenced specification and the contract documents the latter shall govern unless written interpretation is obtained from the Owner. Should there be discrepancies among referenced specifications or standards, the more stringent requirements shall govern.

B. The Contractor shall, if requested, furnish an affidavit from the manufacturer(s) certifying that the materials or products being furnished meet the requirements specified. Such certification, however, shall not relieve the Contractor from the responsibility of complying with other requirements of the contract documents.

1.10 MANUFACTURER'S DIRECTIONS

A. All manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturers unless herein specified to the contrary. Should there be a discrepancy between an installation as required by the drawings and/or specifications and the manufacturer's directions and/or recommendations, such discrepancy shall be brought to the attention of the Architect and shall be resolved before the work may proceed.

1.11 APPROVED MATERIAL REQUIREMENTS

A. In the event the architectural, plumbing, mechanical and/or electrical requirements of any "APPROVED" material is different from that specified and/or as indicated on the drawings, any additional cost involved shall be the responsibility of the Contractor. No extra cost to the Owner or Architect will be allowed because of the use of such materials.

1.12 USE OF FOREIGN MATERIALS

A. The Contractor shall agree to use in the execution of this contract only materials, supplies, and products manufactured, mined, processed or otherwise produced in accordance with the Buy American Act (41 USC 10a-10d).

1.13 EXAMINATION OF SURFACES AND/OR CONDITIONS

A. The Contractor shall examine all surfaces on which, or against which, their work is to be applied and shall notify the Architect in writing of any defects the Contractor may discover which, in the Contractor's opinion, would be detrimental to the proper installation or operation of the Contractor's products. Commencing of work by the Contractor denotes acceptance by Contractor of all surfaces and conditions affecting Contractor's work.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Comply with the Contract Document requirements for Section 01 73 29 Cutting and Patching.
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.01 TEMPORARY OFFICES AND SHEDS

- A. At the Contractor's Option, he may provide an office, storage sheds, and other structures as may be necessary to carry on the work.
- B. Storage sheds shall be of sufficient size to hold materials required on the job site at one time, and shall have floors raised at least 1' 0" above the ground on heavy joists or sleepers. Sheds shall be watertight.

1.02 TELEPHONE (CONTRACTORS OPTION)

A. The Contractor may install, at his own expense, a single party job telephone, which shall be available for the use of all persons concerned with the construction of the project. All official long distance calls shall be paid by the General Contractor.

1.03 TOILET FACILITIES

- A. The Contractor shall, at the beginning of the work, provide on the premises toilet facilities and enclosures for the use of all workmen on the project; shall maintain same in a sanitary condition; and shall remove same at the completion of the building and/ or when directed by the Architect or Owner.
- B. The toilets shall, in construction details, equipment connections, and maintenance conform to all rules, regulations, and requirements of the City or County Health Department having jurisdiction.

1.04 RODENT AND VERMIN CONTROL

A. The Contractor shall provide on the job site ample and suitable containers with covers, and shall be fully responsible for containing and removing from the site all refuse from meals eaten on the site and other rodent or vermin attracting refuse. If the Contractor has the entire site the Contractor is solely responsible for ensuring that the site is rodent and vermin free at the Final Inspection.

1.05 SIGNS

A. No signs will be allowed on the premises except as required by the project specifications and/or as approved by the Owner.

1.06 PROTECTION

A. Provide and maintain all fences, planking, bridges, bracing, shoring, sheet piling, lights, barricades, warning signs, and guards as necessary for the protection of streets, sidewalks, landscaping, adjoining property, and the streets adjacent.

B. Provide protection for all shrubs, trees, lawns, walks, roads, drives, adjacent buildings and equipment, both on and off property, and in roads and streets adjacent.

1.07 REMOVAL

A. Temporary facilities shall be removed promptly as each becomes no longer required, but in all cases no later than the date of Final Acceptance.

1.08 STORAGE AND PARKING AREA

A. The amount of area and location that may be used for parking, storage of materials, equipment, sheds, and offices shall be as indicated by the Drawings or as directed by the Owner.

1.09 FIRST AID PROTECTION

- A. General Contractor shall provide the following:
 - 1. First Aid Accident Cabinets.
 - 2. Emergency telephone numbers posted at telephone.

1.10 FIRE PRECAUTION DURING CONSTRUCTION

A. Emergency fire protection shall be provided for temporary sheds, new work, stacked materials, etc., using extinguishers, water pails and small hose streams, said equipment conforming to the requirements of the National Board of Fire Underwriters and relevant Insurance Co. Particular care shall be exercised when using open flame and welding and cutting equipment; use only flameproof type tarpaulins. Keep site clean and orderly with proper protection of combustibles while in use and in storage.

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.01 PRODUCTS AND MATERIALS

A. Products, Materials, and manufactured items or articles of like nature, shall as nearly as possible, be of one brand or manufacturer. No changes or substitutions shall be made without written consent of the Owner.

1.02 TRADE NAMES

A. The use of manufacturer's names and model numbers are given to establish a standard of manufacture and not intended to be restrictive or preferential. Similar, equal, and approved materials of other manufacturers will be acceptable, subject to the approval of the Owner, pursuant to requirements set forth in Instruction to Bidders and as required by the Specifications.

1.03 MEASUREMENTS

A. Before ordering any material or doing any work, the Contractor shall verify all measurements of the building and shall be responsible for correctness of same. No extra charge or compensation will be allowed because of differences between actual measurements and the dimensions indicated on the Drawings. Any Differences which may be found, shall be submitted to the Architect for consideration before proceeding with the work.

1.04 SALVAGEABLE MATERIAL

A. Any salvageable material and or equipment shall remain the property of the Owner and upon removal from its existing location shall be stored where directed by the Owner. In the event that the Owner does not wish to keep the salvaged material, it shall be the responsibility of the Contractor to remove same promptly form the site.

PART 2 – PRODUCTS

2.01 PRODUCT OPTIONS

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.
- B. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
- C. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

- D. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- E. Where products are accompanied by the term "as selected," Architect will make selection.
- F. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
- G. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
- H. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
- I. Product and Manufacturer Source: Where specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product names, unless otherwise indicated.

2.02 PRODUCT SUBSTITUTIONS

- A. Proposed Substitutions During Bidding: In the technical sections of the specifications under Products heading, where only one manufacturer's specific data including material, model, specification, finish, color, or other specific identification is noted, it is to indicate standards required and that manufacturer's data is automatically approved. If another manufacturers propose to bid on the work, including any other manufacturer listed in the specification section as a manufacturer, the Bidder shall submit full data to the Architect no later than 10 days prior to bid date and shall gain specific approval, via Addendum, on specific products prior to bidding. In the event submitted data of any manufacturer gains approval through this method, the manufacturer and the specific products will be published in an addendum prior to bid date. Only manufacturer's products listed in the original specifications or listed as approved in a subsequent addendum shall be used on the project. No other manufacturers or their products will be considered without prior written consent from the Owner.
- B. Proposed Substitutions After Commencement of The Work: Requests received during construction may be considered only when all of the following specific conditions are satisfied. IF the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Submission, and approval of, Substitution Request Form During Construction – 01 25 14.

- 2. None of the approved products of the specified type are available.
- 3. Requested substitution has been coordinated with other portions of the Work.
- 4. Requested substitution provides specified warranty.

5. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

END OF SECTION
SECTION 01 73 00 - EXECUTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. General installation of products.
 - 3. Progress cleaning.
 - 4. Starting and adjusting.
 - 5. Protection of installed construction.
 - 6. Correction of the Work.
- B. Related Sections include the following:
 - 1. 01 31 00 "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
 - 2. 01 33 00 "Submittal Procedures" for submitting surveys.
 - 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
 - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.03 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 8 feet (2.4 m) in spaces without a suspended ceiling.

- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Final Acceptance.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.04 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
 - Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.

EXECUTION

- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Final Acceptance.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Final Acceptance.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.05 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

3.06 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Final Acceptance.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.07 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace ehipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 – GENERAL

1.01 CUTTING AND PATCHING PROPOSAL:

- A. Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include a description of cutting and patching and changes to existing construction, a list of products to be used and firms or entities that will perform the Work, dates when cutting and patching will be performed, and a list of utilities that cutting and patching procedures will disturb or affect.
- B. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
 - 1. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.
- C. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- D. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
- E. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
 - 1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.
- F. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 – PRODUCTS

2.01 GENERAL:

- A. Comply with requirements specified in other Sections of these Specifications.
- B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
- B. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 1. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.
- C. Temporary Support: Provide temporary support of Work to be cut.
- D. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- F. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas or the remainder of the building(s).
- G. Performance: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- H. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.

- 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
- 6. Proceed with patching after construction operations requiring cutting are complete.
- Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 4. Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
 - 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION

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(Revision Date: 9 April 2021)

PART 1 - GENERAL:

1.01 SUMMARY

A. The work under this Section consists of, but is not limited to; Submittals, Requirements and Procedures for Project close out.

1.02 RELATED SECTIONS

- A. Section 01 33 00 Submittal Procedures
- B. Section 01 78 13 Project Closeout Checklist
- C. Section 00 65 20 Final Completion Form

1.03 SUBMITTALS

- A. Construction Completion Requests
 - 1. Certificate of Final completion
 - 2. Final Inspection
- B. Close out Submittals: Three printed (hard) copies and three electronic copies in Adobe PDF format on CD or DVD-5 of close out submittals of which receipt and acceptance are prerequisites for final payment shall include, but not necessarily be limited to, the following:
 - 1. Affidavit of "Advertisement of Completion". Refer to Section 00 65 13.
 - 2. Evidence of Payments, and Release of Liens.
 - General Contractors "One Year Guarantee". 3.
 - 4. General Contractors "State of Alabama Roofing Guarantee". Refer to Section 00 65 36 (If Applicable).
 - 5. Final Application for Payment.
 - 6. All required warranties and guarantees.

1.04 PUNCH LIST

- A. Any salvageable material and or equipment shall remain the property of the Owner and upon removal from its existing location shall be stored where directed by the Architect. In the event that the Owner does not wish to keep the salvaged material, it shall be the responsibility of the Contractor to remove same promptly from the site.
- B. Inspection:
 - 1. Prior to completion of the project, the Contractor shall fully prepare their own written Punch List. Upon completing correction of all Contractor generated Punch List items, the Contractor shall forward to the Owner and Architect a copy of their Punch List along with written notification that they have completed their entire list of items and are requesting a formal Punch List inspection.
 - 2. When the Owner confirms the Inspection date and time, the Architect will notify all parties in writing via e-mail the confirmed date and time for the Inspection.

Cancellations of any scheduled Inspection must be received in writing no later than 48 hours prior to the scheduled Inspection. If the Inspection is canceled, it will be rescheduled subject to the Owner and Architect's availability. Cancellations received less than 48 hours in advance shall incur a minimum \$1,500.00 re-inspection fee.

- 3. The Contractor is responsible for ensuring they and all their Sub-Contractors are completely ready for all Commissioning Activities and Inspections. If the Contractor and /or any of their associated Sub-contractors are not ready, then the Owner reserves the option to deduct from the Contractor all costs for the A/E team and Owner team participation due to failure of the Contractor and/or their Sub-contractors to be ready for Commissioning Activities or Inspections.
- C. Rejection of Certification by Contractor:
 - 1. Should the Architect consider that work is not complete he will, on completion of inspection, immediately notify Contractor, in writing, stating reasons. Contractor shall complete work and send second written notice to the Architect certifying that project, or designated portion of project, is complete, after which the Architect and Owner representative will inspect work.

1.05 FINAL INSPECTION

- A. Certification: Contractor shall submit written certification that: Contract Documents have been reviewed; project has been inspected for compliance with Contract Documents; Work has been completed in accordance with Contract Documents; Equipment and Systems have been tested in presence of Owner's Representative and are operational and Project is completed and ready for final inspection.
- B. Inspection: Architect and Owner will make final inspection of the project within a reasonable time after receipt of certification. Should Owner consider that work is in fact complete in accord with requirements of Contract Documents, he will request Contractor to make Project Closeout Submittals. Should Owner consider that work is not complete, he will notify Contractor, in writing, stating reasons. Contractor shall take immediate steps to remedy stated deficiencies, and send second written notice to Architect certifying that work is complete. The Architect and Owner will re-inspect the work.
- C. Certificate of Final Completion: Should the Owner consider that work is complete:
 - 1. Architect will prepare and issue a Certificate of Final Completion, or approved equal, complete with signatures of Owner and Contractor.
 - 2. For Owner occupancy of Project or designated portion of project, Contractor shall: perform final cleaning; and Contractor shall complete work listed for completion or correction, within designated time.

1.06 AS-BUILT DRAWINGS

A. Upon completion of this contract, the Contractor shall deliver to the Owner, at the Final Inspection, the three complete sets of legible drawings which vary from the original contract documents, showing all construction equipment, mechanical and electrical systems and connections as installed or built. All lettering and drawings shall be neat and recorded in permanent ink. The record drawings shall be supplemented by detailed

sketches or drawings when necessary. "As-Built" Drawings not legible shall be completely redone.

- B. The Owner shall approve Record Drawings, and shall be the sole judge of the acceptability of the Drawings.
- C. Submit three electronic copies of all as built documents in Adobe PDF format on CD or DVD-5, simultaneous with the Closeout Documents.

1.07 OPERATION AND MAINTENANCE DATA

- A. If applicable furnish three (3) complete sets of manuals containing manufacturer's instructions for operation and maintenance of each item of equipment and apparatus furnished under the Contract, detailed parts list and any additional data specifically required under various sections of the Specifications. Manuals shall be arranged in proper order, indexed and suitably bound in a 3-ring loose-leaf binder for 8 1/2" X 11" paper with black vinyl covers. Label binder with embossed plastic tape designating the name of Project, Owner, Contractor, and equipment of materials included in the manual. Certify by endorsement therein that each of the manuals is complete and accurate. Deliver manuals to the Owner at the Final Inspection of the project.
- B. Submit three electronic copies of all manuals and documents in Adobe PDF format on CD or DVD-5, simultaneous with the Closeout Documents.
- C. Special Requirements Mechanical (if applicable): Operating instructions for the principal plant mechanical components, for use by operating personnel, shall be provided. They shall be laminated between thermoplastic sheets and affixed where directed by the Architect or Owner. Instructions shall describe the function of the equipment, its most economical operation, start-up and shut-down procedures, procedures to follow in event of failure, normal maintenance practices, and caution and warning notices.
- D. Special Requirements Electrical (if applicable): Frame under glass, or clear plastic, one print of the "As-Built" power riser diagram at main switch or switchboard location or at a location directed by the Architect or Owner. Provide circuit identification for each circuit in each panel board cabinet.

1.08 GUARANTEES AND BONDS

A. Contractor shall submit to the Architect, simultaneous with the Closeout Documents, all warranties, guarantees, and Surety Bonds. All such documents shall show the name and location of the Project and the name of the Owner.

1.09 INSTRUCTIONS

A. Instruct Owner's personnel in required roof maintenance and operation of all systems, mechanical, electrical and other equipment, prior to requesting the Punch List Inspection.

- A. Immediately after completion of the Contract, but not before receipt of a fully executed Final Completion Form, the General Contractor shall give notice of completion by an advertisement in the newspaper of general circulation published within the City or County wherein the work was done, once a week for four consecutive weeks.
- B. In no case will a final settlement be made upon the Contract until the expiration of thirty (30) days from commencement of advertisement or before receipt of advertisement with affidavit as required by law.
- C. Proof of publication of this Notice shall be submitted by the General Contractor, simultaneous with the Closeout Documents, by Affidavit of the publisher and a printed copy of the notice published. If no newspaper is published in the County, the notice must be posted at the Courthouse for thirty (30) days and proof shall be made by the Probate Judge or Sheriff and the Contractor.

1.11 EVIDENCE OF PAYMENTS AND RELEASE OF LIENS

- A. Submit contractor's Affidavit of Payment of Debts and Claims: AIA G706, or approved equal.
- B. Submit Contractor's Affidavit of Release of Liens: AIA G706A, or approved equal, with:
 - 1. Consent of Surety to Final Payment: AIA G707, or approved equal.
 - 2. Contractor's Release or Waiver of LIENS.
- C. All submittals shall be duly executed before delivery to the Architect.

1.12 GENERAL CONTRACTORS GUARANTEE

A. The General Contractor shall submit in addition to any other expressed guarantees and/or warranties, a guarantee of all work under this Contract for a period of one year from date of final acceptance. Also, the General Contractor shall provide the State of Alabama Five-Year Roof Guarantee - if applicable.

1.13 FINAL ADJUSTMENT OF ACCOUNTS

- A. Submit final statement of accounting to the Architect. Statement shall reflect all adjustments, including, but not necessarily limited to, the following:
 - 1. Original Contract Sum.
 - Additions and deductions resulting from: 2.
 - a. Previous change orders.
 - b. Cash allowances.
 - c. Unit Prices.
 - d. Other adjustments.
 - e. Deductions for uncorrected work.
 - f. Penalties and bonuses.
 - g. Deductions for liquidated damages.
 - Total Contract Sum, as adjusted. 3.

- 4. Previous payments.
- 5. Sum remaining due.

1.14 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit final application in accord with requirements of General and/or Supplementary Conditions, simultaneous with the Closeout Documents.

1.15 YEAR END INSPECTION

A. Sixty days prior to expiration of one year from date of "Final Acceptance" Contractor shall notify the Architect, in writing, of year-end inspection. Year-end inspection shall occur no more than forty-five and no less than fifteen days before the expiration of the Contractor's one year warranty. The Architect will make visual inspection of project in company with Owner and Contractor to determine whether correction of work is required, in accordance with provisions of General Conditions. For guarantees beyond one year, Architect will make inspections at request of Owner, after notification to Contractor. The Architect will promptly notify Contractor, in writing, of any observed deficiencies.

END OF SECTION

SECTION 01 78 13 - PROJECT CLOSEOUT CHECKLIST

PART 1 - GENERAL:

1.01 SUMMARY

A. This Section consists of a shortform checklist for required closeout documents / submittals.

1.02 RELATED SECTIONS

A. Section 01 77 00 - Project Closeout

1.03 REQUIREMENTS

- A. See Section 01 77 00 for the full requirements of each of the following:
 - 1. Fully executed copy of the Certificate of Final Completion with copy of original punchlist
 - 2. Original Affidavit of "Advertisement of Completion" a copy of the ad must be attached to the affidavit form. (Not required if original awarded contract is less than \$50,000.00)
 - 3. General Contractor's Affidavit of Release of Liens
 - 4. General Contractor's Affidavit of Payment of Debts and Claims AIA G706A or approved equal
 - 5. Consent of Surety to Final Payment AIA G707 or approved equal (Not required if original awarded contract is less than \$50,000.00)
 - 6. General Contractors "One Year Guarantee"
 - 7. General Contractor's "State of Alabama Roof Guarantee" if applicable
 - 8. Other warranties as required by contract
 - 9. As-Built Drawings Changes should be legible, in permanent ink, and supplemented by detailed sketches or drawings when necessary
 - Operating and Maintenance Manuals / Submittal / Product Literature & Technical Data

1.04 SUBMITTALS

- A. Closeouts shall be submitted to the Architect in the following packages:
 - 1. Package #1 Final Pay Application Package contains at least two (2) original pay applications with items #1 #5 attached with binder clip or stapled not in three ring binder or paper clipped.
 - 2. Package #2 Warranty Package contains items #6 #8 attached with binder clip or stapled - not in three ring binder or paper clipped.
 - 3. Package #3 Copy Package contains copies of items #1 #8 attached with binder clip or stapled not in three ring binder or paper clipped.
 - Package #4 Compact Disc Package contains scans of items #1 #10 in PDF format on a single CD, three CDs total, with each item saved by number from 1.03.A (above).

END OF SECTION

PROJECT CLOSEOUT CHECKLIST

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SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 SUMMARY

- A. This section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings (As-Builts)
 - 2. Record Product Data
- B. Related Sections:
 - 1. Section 01 77 00 Project Closeout

1.02 SUBMITTALS

1.03 RECORD DRAWINGS: COMPLY WITH THE FOLLOWING:

A. Record Drawings - number of copies:

1. Punch-list Inspection: Submit one marked-up (red-lined) Record Drawings to the Architect and Owner's Representative at the start of the Punch-list Inspection for review. Any noted deficiencies are to be corrected prior to the Final Inspection.

2. Final Inspection: Submit three marked-up (red-lined) Record Drawings and three electronic CD copies containing all drawings in PDF format to the Owner at the start of the Final Inspection. Failure to provide the Record Prints (hard copy and/or CD), in the required quantities at the start of the Final Inspection, may result in the Owner immediately terminating the Final Inspection.

B. Record Project Data - number of copies:

 Punch-list Inspection: Submit one set of Record Product Data for each item to the Architect and Owner's Representative at the start of the Punch-list Inspection for review. Any noted deficiencies are to be corrected prior to the Final Inspection.
 Final Inspection: Submit three sets of corrected, bound Record Product Data and three electronic CD copies containing all Record Product Data in PDF format to the Owner at the start of the Final Inspection. Failure to provide the Record Product Data (hard copy and/or CD), in the required quantities at the start of the Final Inspection, may result in the Owner immediately terminating the Final Inspection.

PART 2 – PRODUCTS

2.01 RECORD DRAWINGS

- A. Record Prints: Maintain one set of black-line white prints of the Contract Drawings and Shop Drawings at Project Site.
 - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

- a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
- b. Accurately record information in an understandable drawing technique.
- c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
- d. Content: Types of items requiring marking include, but are not limited to, the following:
 - 1) Dimensional changes to Drawings
 - 2) Revisions to details shown on Drawings
 - 3) Depths of foundations below first floor
 - 4) Locations and depths of underground utilities
 - 5) Revisions to routing of piping and conduits
 - 6) Revisions to electrical circuitry
 - 7) Actual equipment locations
 - 8) Duct size and routing
 - 9) Locations of concealed internal utilities
 - 10) Changes made by Change Order or Construction Change Directive
 - 11) Changes made following Contract Modifications
 - 12) Details not on the original Contract Drawings
 - 13) Field records for variable and concealed conditions
 - 14) Record information on the Work that is shown only schematically
 - 15) Changes made by Addenda
 - 16) Changes/Clarifications made by Contract Directive
 - 17) Changes made by approved Shop Drawings
- e. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings and physically append the Shop Drawings to final Record Drawings.
- f. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
- g. Mark important additional information that was either shown schematically or omitted from original Drawings.
- h. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, Addendum number(s), and similar identification, where applicable.
- B. Record Drawings: When authorized, prepare a full sets of drawings of the corrected Contract Drawings, and record copy of all Shop Drawings.
 - 1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw and add details and notation where applicable.
 - 2. Refer instances of uncertainty to Architect for resolution.
 - 3. Architect will furnish Contractor one set of Contract Drawings in electronic format, or .pdf files, for use in recording information.
 - 4. Print the Contract Drawings and Shop Drawings for use as Record Drawings.
- C. Format: Identify and date Record Drawing; include the designation "PROJECT RECORD DRAWING (AS-BUILTS)" in prominent location on the cover sheet.
 - 1. Record Drawings: Organize into bound sets. Place Drawings in durable tube-type drawing containers with end caps. Mark end cap of each container with

identification. If container does not include a complete set, identify Drawings included.

- 2. Identification: As follows:
 - a. Project name
 - b. Date
 - c. Designation "PROJECT RECORD DRAWINGS (AS-BUILTS)"
 - d. Name of Architect
 - e. Name of Contractor

2.02 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of the project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Owner's and Architect's reference during normal working hours.

END OF SECTION

			Maintenan	ce Materials (Attic	Stock]/Replacement	Stock List	
Mâterial Name	% Materials	Manufacturer	Mfr. Number	Description	Product Type (mech, elect, HVAC, plumbing, controls, etc.)	Est. Current Cost	Date of Entry
Interior Items							
Ceiling Tiles	5%						
Window coverings	5%						
Ceramic Wall Tiles - field tiles	3%						
Ceramic Wall Tiles - specialty tiles	10%						
Paint	5% - not less than 1 gallon						
Flaoring							
Carpet Tiles	5%						
Resilient Base	10 LF per 500 LF						
Resilient Flooring -Tiles	1 Box per 50 Boxes						
Hard Tile	3%						
Grout	5%						
Electrical							
Lamps (each type)	5%			22			
Exterior Items							
Paint	5% - not less than 1 gallon						
Brick/Split Face CMU	3%						
Wall pack lamps	5% - not less than 1						

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SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training video recordings.
- B. Related Requirements:
 - 1. Divisions 01 through 49 Sections: Specific requirements for demonstration and training for products in those Sections.

1.02 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module. This schedule must be submitted to the Architect <u>AT LEAST 14 DAYS IN ADVANCE</u> of the proposed training dates if multiple dates are proposed, then the schedule must be submitted at least 14 days in advance of the earliest date on the schedule. Submission of the schedule after with less than fourteen days before the first date shall be sufficient grounds, by itself, for the Owner to reject the schedule, or any portion of the schedule. If the schedule is rejected by the Owner, then it will be rescheduled at no additional expense to the Owner or Architect. <u>ALL OPERATOR TRAINING MUST TAKE PLACE, AND RECORDINGS (1.03 A.) MUST BE PROVIDED TO ARCHITECT, PRIOR TO THE PUNCH LIST INSPECTION.</u> Failure to conduct and provide recordings prior to the Punch List Inspection will be grounds for cancellation of the Punch List Inspection.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For facilitator, instructor, and videographer.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.03 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two (2) copies within seven (7) days of end of each training module.

- 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date of video recording.
- 2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
- 3. At Final Inspection, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format on compact disc.

1.04 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in "Section 01 40 00 Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Pre-instruction Conference: Conduct conference at Project site. Review methods and procedures related to demonstration and training including, but not limited to, the following:
 - 1. Inspect and discuss locations and other facilities required for instruction.
 - Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 - 3. Review required content of instruction.
 - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.05 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.

- h. Normal shutdown instructions.
- i. Operating procedures for emergencies.
- j. Operating procedures for system, subsystem, or equipment failure.
- k. Seasonal and weekend operating instructions.
- I. Required sequences for electric or electronic systems.
- m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual.
- B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.

- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Architect with at least fourteen (14) days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a performance-based test.
- F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.03 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.
 - 1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
 - 2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
 - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. E-mail address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
 - 1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.

- c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
 1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Pre-produced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

Northport FMS#9 Renovations Northport, AL SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS (Revision Date: 9 April 2021)

PART 1 - GENERAL

1.1 DESCRIPTION

- Commissioning: Commissioning is a systematic process of ensuring that all building Α. energy systems perform interactively according to the design intent and the Owner's operational needs. The commissioning process for this project shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, and performance testing. Commissioning during the construction phase includes a commissioning kick-off meeting, pre-functional checks, and any site visits prior to functional performance testing of mechanical and electrical systems. The acceptance phase includes the functional testing of the mechanical and electrical systems at the time each Bid Item is ready for the Owner's occupancy. Commissioning is intended to achieve the following specific objectives according to the Contract Documents:
 - 1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
 - Verify and document proper performance of equipment and systems. 2.
 - 3. Verify that the Owner's operating personnel are adequately trained.
- Β. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.
- C. Abbreviations: The following are common abbreviations used in the Specifications and in the Commissioning Plan. Definitions are found in Section 1.6.

A/E	Architect/Engineer	FPT	Functional Performance Test
CxA	Commissioning Authority	GC	General Contractor (prime)
CxE	Electrical Commissioning Specialist	CxM	Mechanical Commissioning Specialist
TAB	Test and Balance	PM	
Сх	Commissioning	PFT	Pre-functional Test Checklist

1.2 COORDINATION

Northport FMS#9 Renovations Northport, AL

- A. Commissioning Team: The members of the commissioning team consist of the Commissioning Authority (CxA), the Mechanical Commissioning Specialist (CxM), the Electrical Commissioning Specialist (CxE), the Project Manager (PM), the Field Coordinator (FC), the General Contractor (GC or Contractor), the Architect/Engineer and design engineers (particularly the mechanical and electrical engineers), the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB representative (TAB), the Controls Contractor (CC), and any other installing subcontractors or suppliers of equipment. If known, the Owner's building or plant operator/engineer is also a member of the commissioning team.
- B. Management: The CxA is hired by the Owner or Owner's Representative directly. The CxA directs and coordinates the commissioning activities and is part of the PM team. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents. The CxA's responsibilities are the same regardless of who hired the CxA. Refer to Section 019113 Part 1.5 for additional management details.
- C. Scheduling: The CxA will work with the PM, OR, and GC according to protocols established herein to schedule the commissioning activities. The CxA will provide sufficient notice to the OR and GC for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.
- D. The CxA will provide the initial schedule of primary commissioning events at the commissioning scoping meeting. The Construction Phase Commissioning Plan provides a format for this schedule. As construction progresses, more detailed schedules are developed by the CxA. The Commissioning Plan also provides a format for detailed schedules.

1.3 COMMISSIONING PROCESS

- A. Commissioning Plan: The commissioning plan provides guidance in the execution of the com- missioning process. Just after the initial commissioning scoping meeting, the CxA will update the plan which is then considered the "final" plan, though it will continue to evolve and expand as the project progresses. The Commissioning Plan will act as a complementary document to the Specifications..
- B. Commissioning Process: The following narrative provides a brief overview of the typical com- missioning tasks during construction and the general order in which they occur.
 - 1. Commissioning during construction begins with a scoping meeting conducted by the CxA where the commissioning process is reviewed with the commissioning team members.
 - 2. The CxA will provide to the Owner, who will issue to the Contractor as a contract directive, the mechanical and electrical contractors Pre-Functional Test (PFT) procedures that are based on the contract documents, manufacturers' start-up procedures, and best practices developed by the HVAC and Electrical industries.
 - 3. In general, the checkout and performance verification proceeds from simple to

GENERAL COMMISSIONING REQUIREMENTS

complex; from component level to equipment to systems and intersystem levels with pre-functional checklists being completed before functional testing.

- 4. The Contractor, under their own direction, execute and document the pre-functional checklists and perform startup and initial checkout. The CxA documents that the checklists and startup were completed according to the approved plans. This may include the CxA or technical Cx representatives witnessing start-up of selected equipment.
- 5. The CxA develops specific equipment and system functional performance test procedures. The Owner will provide the test procedures to the Contractor by contract directive. The Constractor will review the procedures and conduct internal tests of equipment and systems prior to requesting official functional performance testing with the CxA or technical Cx representatives. This helps the Contractor verify that the systems are ready for official testing, and it also minimizes failed tests and retesting efforts.
- 6. The functional performance testing procedures are executed by the Contractor in accordance with the approved schedule and documented by the CxA.
- 7. Items of non-compliance in material, installation, or setup are corrected at the Contractor's sole expense and the system retested.
- 8. Deferred testing is conducted as specified or required.

1.4 RELATED WORK

- A. Specific commissioning requirements are given in the following sections of these specifications. All of the following sections apply to the Work of this section.
 - 1. Section 01 77 00 "Project Closeout" defines Substantial Completion and Functional Completion milestones, relative to commissioning.
 - Section 23 08 00 "Commissioning of HVAC Systems" describes the mechanical contractor's responsibilities to commissioning as called out in Section 01 91 13 "General Commissioning Requirements."
 - Section 26 08 00 "Commissioning of Electrical Systems" describes the electrical contractor's responsibilities to commissioning as called out in Section 01 91 13 "General Commissioning Requirements."
 - 4. Section 28 08 00 "Commissioning of Fire Alarm Systems" describes the fire alarm contractor's responsibilities to commissioning as called out in Section 01 91 13 "General Commissioning Requirements."

1.5 **RESPONSIBILITIES**

A. The responsibilities of various parties in the commissioning process are provided in this section. The responsibilities of the mechanical contractor, TAB and controls contractor are in Division 23. The responsibilities of the electrical contractor are in Division 26. The responsibilities of the Fire Alarm Contractor are in Division 28. It is noted that the services for the Project Manager, Field Coordinator, Architect/Engineer, mechanical and electrical designers/engineers, and Commissioning Authority are not provided for in this contract. That is, the Contractor is not responsible for providing their services. Their responsibilities are listed here to clarify the commissioning process.

- B. All Parties
 - 1. Follow the Commissioning Plan.
 - 2. Attend commissioning scoping meeting and additional meetings, as necessary.
- C. Commissioning Authority (CxA)

The CxA is not responsible for design concept, design criteria, compliance with codes, design, or general construction scheduling, cost estimating, or construction management. The CxA may assist with problem-solving non-conformance or deficiencies, but ultimately, that responsibility resides with the General Contractor and the A/E. The primary role of the CxA is to develop and coordinate the execution of a testing plan, observe, and document performance that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, check out, and functionally test equipment and systems, except for specified testing with portable data- loggers, which shall be supplied and installed by the CxA.

- 1. Construction and Acceptance Phases
 - a. Coordinates the commissioning activities in a logical, sequential, and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules, and technical expertise.
 - b. Plan and conduct a commissioning scoping meeting.
 - c. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up, and checkout procedures.
 - d. Before startup, gather and review the current control sequences and interlocks, and work with the Contractor and Architect until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
 - e. Write and distribute pre-functional tests and checklists to the Owner.
 - f. Draft pre-functional tests and checklist completion by reviewing prefunctional check-list reports and by site observation and spot checking.
 - g. With necessary assistance and review from the Contractor, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring, or manual functional testing.
 - h. Analyze any functional performance trend logs and monitoring data to verify performance.
 - i. Coordinate, witness, and perform functional performance tests performed by the Contractor. Coordinate retesting as necessary until satisfactory performance is achieved.
 - j. Maintain a master deficiency and resolution log (Issue Log). Provide the PM with electronic copy of issues with recommended actions.
 - k. Compile test data, inspection reports, and certificates, and provide a final

commissioning report (as described in this section) to the Owner.

- 2. Warranty Period
 - a. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
- D. General Contractor (GC)
 - 1. Construction and Acceptance Phase
 - a. Facilitate the coordination of the commissioning work by the CxA, and with the PM, ensure that commissioning activities are being scheduled into the master schedule.
 - b. Include the cost of commissioning in the total contract price.
 - c. Furnish a copy of all construction documents, addenda, change orders, and approved submittals and shop drawings related to commissioned equipment to the CxA.
 - d. A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CxA to facilitate the Cx process.
 - e. Coordinate owner training on commissioned systems. Provide minimum 10 days' notice prior to scheduling training activities. Provide training agenda and training sign-in sheet to document attendance. Provide copies of training agenda and completed sign-in sheet to CxA.
 - f. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
 - 2. Warranty Period
 - a. Ensure that the seasonal or deferred functional performance testing is executed, as witnessed by the CxA, according to the specifications.
 - b. Ensure that deficiencies are corrected and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

1.6 DEFINITIONS

- A. Acceptance Phase phase of construction after startup and initial checkout when functional performance tests, O&M documentation review, and training occurs.
- B. Basis of Design (BOD) The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions, and methods chosen to meet the intent. Some reiterating of the design intent may be included.
- C. Commissioning Authority (CxA) an independent agent, not otherwise associated with

the A/E team members or the Contractor, though he/she may be hired as a subcontractor to them. The CxA directs and coordinates the day-to-day commissioning activities. The CxA does not take an oversight role and will not make recommendations to the General Contractor for remediation. The CxA is part of the Owner's team and shall report directly to the Owner.

- D. Commissioning Plan an overall plan, developed before or after bidding, that provides the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- E. Control system the central building energy management control system
- F. Data-logging monitoring flows, currents, status, pressures, etc. of equipment using stand-alone data-loggers separate from the control system.
- G. Deferred Functional Performance Tests FPTs that are performed later, after beneficial occupancy or final acceptance, due to partial occupancy, equipment, seasonal requirements, design, or other site conditions that disallow the test from being performed.
- H. Deficiency a condition in the installation or function of a component, piece of equipment, or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).
- I. Design Intent (Also see OPR) a dynamic document that provides the explanation of the ideas, concepts, and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases. Sometimes it is referred to as Owner's Project Requirements.
- J. Design Narrative or Design Documentation sections of either the Design Intent or Basis of Design.
- K. Electrical Commissioning Specialist (CxE) commissioning specialist that reports directly to the CxA and performs the technical work associated with each electrical system to be commissioned.
- L. Factory Testing testing of equipment on-site or at the factory, by factory personnel with an Owner's representative present.
- M. Functional Performance Test (FPT) test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional performance testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional
testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees, and documents the actual testing, which is usually performed by the installing contractor or vendor. FPTs are performed after pre-functional checklists, start-up, and TAB are complete.

- N. Indirect Indicators indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.
- O. Manual Test using hand-held instruments, immediate control system read-outs, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").
- P. Mechanical Commissioning Specialist (CxM) commissioning specialist that reports directly to the CxA and performs the technical work associated with each mechanical system to be commissioned.
- Q. Monitoring the recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data-loggers or the trending capabilities of control systems.
- R. Non-Compliance see Deficiency.
- S. Non-Conformance see Deficiency,
- T. Over-written Value writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50°F to 75°F to verify economizer operation). See also "Simulated Signal."
- U. Owner-Contracted Tests tests paid for by the Owner outside the GC's contract. These tests will not be repeated during functional tests if properly documented.
- V. Owner's Project Requirements (OPR) A written document that details the functional requirements of a project and the expectations of how it will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. (The term Design Intent is used by some Owners for their Commissioning Process Owner's Project Requirements.)
- W. Phased Commissioning commissioning that is completed in phases (by floors or by building, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.
- X. Pre-functional Test (PFT) a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CxA to the Sub. Pre-functional tests are checklists to primarily conduct static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some pre-functional tests entail simple testing of the function of a component, a piece of equipment, or system

(such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The word pre-functional refers to before functional testing. Pre-functional tests augment and are combined with the manufacturer's start-up checklist. Even without a commissioning process, contractors typically perform some, if not many, of the prefunctional test items a CxA will recommend. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The CxA only requires that the procedures be documented in writing and does not witness much of the pre-functional tests, except for larger or more critical pieces of equipment.

- Y. Recommendations to the Owner acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.
- Z. Sampling Functionally testing only a fraction of the total number of identical or near identical pieces of equipment. Refer to 019113 Part 3.5 E.
- AA.. Seasonal Performance Tests FPT that are deferred until the system(s) will experience conditions closer to their design conditions.
- BB. Simulated Condition condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).
- CC. Simulated Signal disconnecting a sensor and using a signal generator to send an amperage, resistance, or pressure to the transducer and DDC system to simulate a sensor value.
- DD. Specifications the construction specifications of the Contract Documents
- EE. Startup the initial starting or activating of dynamic equipment, including executing pre-functional checklists
- FF. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.
- GG. Test Procedures the step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CxA, CxM, and CxE.
- HH. Test Requirements requirements specifying what modes and functions, etc., shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the Contract Documents (Sections 23 08 00; 26 08 00, etc.).
- II. Trending monitoring using the building control system.

1.7 SYSTEMS TO BE COMMISSIONED

A. The following equipment and systems will be commissioned in this project. Equipment types and quantities will vary per Bid Item.

- 1. Mechanical:
 - a. Geothermal loop field with associated pumps and heat exchangers
 - b. Hydronic building loop pumps
 - c. Air/dirt separators
 - d. Geothermal water-source heat pumps
 - e. Water-cooled variable refrigerant flow (VRF) heat recovery units
 - f. Air-cooled VRF outdoor units
 - g. VRF indoor evaporator units
 - h. Electric cooling / gas heating split-system units
 - i. Packaged DX gas-fired air-conditioning units
 - j. Ductless air-conditioning units and/or heat pumps
 - k. Through-wall heat pump units
 - 1. Exhaust/supply fans
 - m. Destratification fans
 - n. Electric wall heaters
 - o. Gas-fired unit heaters
 - p. Gas infrared heaters
 - q. Dehumidifiers
 - r. Kitchen hoods and associated exhaust/supply fans
 - s. Carbon monoxide detection system
 - t. Gas submeters
 - u. Water submeters
 - v. Testing, Adjusting and Balancing (TAB) work
 - w. Central Building Automation System including linkage of remote monitoring and control sites
- 2. Electrical:
 - a. Lighting controls (interior and exterior)
 - b. Exit egress lighting
 - c. Power
 - i. Service entrance equipment
 - ii. Panelboards
 - iii. Disconnect switches
 - iv. Receptacles
 - v. Manual transfer switches and pin & sleeve connectors
 - vi. Submeters
 - d. Fire alarm and mass notification systems

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Contractor.

- B. Special equipment, tools, and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site, except for stand-alone data- logging equipment that may be used by the CxA.
- C. Data-logging equipment and software required to test equipment may be provided by the CxA but shall not become the property of the Contractor.
- D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to accuracy of 0.5 deg-F and a resolution of + or - 0.1 deg-F. Relative humidity sensors and digital hygrometers shall have a certified calibration within the past year to accuracy of + or - 2.0% of the value range being measured (not full range of meter). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.
- E. Refer to Part 3.5 E for details regarding equipment that may be required to simulate required test conditions.

PART 3 - EXECUTION

3.1 MEETINGS

A. Scoping Meeting: Within 60 days of commencement of construction, the CxA will schedule, plan, and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CxA. Information gathered from this meeting will allow the CxA to revise the Preliminary Commissioning Plan to its "final" version, which will also be distributed to all parties.

3.2 REPORTING

- A. The CxA will provide regular reports to the Owner with increasing frequency as construction and commissioning progresses.
- B. The CxA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.
- C. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.
- D. A final summary report (about four to six pages, not including backup documentation) by the CxA will be provided to the Owner, focusing on evaluating commissioning process

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issues and identifying areas where the process could be improved. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report.

3.3 SUBMITTALS

- A. The CxA will provide the Contractor with a specific request for the type of submittal documentation the CxA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At mini- mum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings, and details of owner contracted tests. ALL SUBMITTALS SHALL BE PROVIDED IN PDF ELECTRONIC FORMAT. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the CxA. All documentation requested by the CxA will be included by the Contractor in their O&M manual contributions.
- B. The CxA will review and approve submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment, and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The Commissioning Authority will review the submittals concurrently with the Owner and will notify the Owner and PM of items missing or areas that are not in conformance with Contract Documents and which requires resubmission.
- C. The CxA may request additional design narrative from the A/E and/or Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.
- D. These submittals to the CxA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CxA will review them.

3.4 START-UP, PREFUNCTIONAL CHECKLISTS, AND INITIAL CHECKOUT

- A. The following procedures apply to all equipment to be commissioned, according to Section 1.7, Systems to be Commissioned. Some systems that are not comprised of actual dynamic machinery, e.g., electrical system power quality, may have very simplified PFC's and startup.
- B. General. Pre-functional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full pre-functional checkout. No sampling strategies are used. The pre-functional testing for a given system must be successfully completed prior to formal functional

performance testing of equipment or subsystems of the given system.

- C. Start-up and Initial Checkout Plan: The CxA shall assist the commissioning team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CxA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for pre-functional checklists and startup are identified in the commissioning scoping meeting and in the checklist forms.
 - 1. The CxA adapts, if necessary, the representative pre-functional checklists and procedures from the Commissioning Plan. These checklists indicate required procedures to be executed as part of startup and initial checkout of the systems and the party responsible for their execution.
 - 2. These checklists and tests are provided by the CxA to the Contractor. The Contractor determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form will have more than one trade responsible for its execution.
 - 3. The Contractor is responsible for developing the full start-up plan by combining (or adding to) the CxA's checklists with the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.

The full start-up plan could consist of something as simple as:

- a. The CxA copies the manufacturer's startup and initial checkout procedures from O&M submittals.
- b. The CxA marks the applicable areas in the procedures and makes initial and date lines at each procedure or section.
- c. The CxA transmits these procedures and the original pre-functional checklist procedures (see 1 above) to the Contractor as the startup and initial checkout plan.
- 4. The Contractor submits the full startup plan to the CxA for review and approval.
- 5. The CxA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.
- D. Execution of Pre-Functional Checklists and Startup
 - 1. Four weeks prior to startup, the Contractor schedules startup and checkout with the PM, A/E, and CxA. The performance of the pre-functional checklists, startup, and checkout are directed and executed by the designee of the Contractor (i.e., Sub or vendor). When checking off pre-functional checklists, signatures may be required for verification of completion of their work.
 - 2. The Contractor's designee (i.e., Subs and vendors) shall execute startup and provide the CxA with a signed and dated copy of the completed start-up and pre-functional tests and checklists.

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- 3. Only individuals that have direct knowledge and witnessed that a line-item task on the pre-functional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.
- E. Deficiencies, Non-Conformance, and Approval in Checklists and Startup.
 - 1. The Contractor shall clearly list any outstanding items of the initial start-up and pre-functional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CxA within two days of test completion.
 - 2. The CxA reviews the report and submits either a non-compliance report or an approval form to the Contractor, A/E, and PM. The CxA shall work with the Contractor to correct and re-test deficiencies or uncompleted items. The CxA will involve the PM and others as necessary. The Contractor shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner and shall notify the CxA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CxA recommends approval of the execution of the checklists and startup of each system to the PM using a standard form.
 - 3. Items left incomplete, which later cause deficiencies or delays during functional testing, may result in back-charges to the responsible party. Refer to Part 3.6 herein for details.

3.5 FUNCTIONAL PERFORMANCE TESTING

- A. This sub-section applies to all commissioning functional testing for all divisions.
- B. The general list of equipment to be commissioned is found in Paragraph 1.7.
- C. Objectives and Scope: The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part-and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc., shall also be tested.

D. Development of Test Procedures. Before test procedures are written, the CxA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements in Sections 23 08 00, 26 08 00, and 28 08 00, the CxA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. The Contractor shall provide limited assistance to the CxA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CxA shall provide a copy of the test procedures to the Contractor who shall review the tests for feasibility, safety, equipment, and warranty protection. The CxA may submit the tests to the A/E for review, if requested by the Owner.

The test procedure forms developed by the CxA shall include (but not be limited to) the following information:

- 1. System and equipment or component name(s)
- 2. Equipment location and ID number
- 3. Unique test ID number and reference to unique pre-functional checklist and startup documentation ID numbers for the piece of equipment
- 4. Date
- 5. Project name
- 6. Participating parties
- 7. A copy of the specification section describing the test requirements
- 8. A copy of the specific sequence of operations or other specified parameters being verified
- 9. Formulas used in any calculations
- 10. Required pre-test field measurements
- 11. Instructions for setting up the test.
- 12. Special cautions, alarm limits, etc.
- 13. Specific step-by-step procedures to execute the test, in a clear, sequential, and repeatable format
- 14. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
- 15. A section for comments
- 16. Signatures and date block for the CxA
- E. Test Methods.
 - 1. Functional performance testing and verification may be achieved by manual testing (per- sons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data-loggers. CxA may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the Owner. This may require a change order and adjustment in charge to the Owner. The CxA will determine which method is most appropriate for tests that do not have a method specified.
- F. Coordination and Scheduling: The Contractor shall provide sufficient notice to the CxA regarding their completion schedule for the pre-functional checklists and startup of all equipment and systems. The CxA will schedule functional tests through the PM, GC, and A/E. The CxA or technical Cx representatives shall direct, witness, and document the functional testing of all equipment and systems. The Contractor shall execute the tests.

In general, functional testing is conducted after pre-functional testing and startup has been satisfactorily completed. The control system must have been sufficiently tested by the Contractor and found in accordance with the Contract Documents by the CxA before it is used for TAB or to verify performance of other components or systems. The air and water balancing is to be completed and de-bugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked. The Contractor is responsible for reviewing the functional testing procedure documents provided by the CxA and conducting internal tests of equipment and systems prior to requesting official functional performance testing with the CxA or technical Cx representatives. This allows the Contractor to verify that the systems are ready for official testing, and it also minimizes failed tests and retesting efforts. Functional Performance Testing will occur simultaneously for all buildings in a particular Bid Item, so all systems and equipment in that Bid Item must be ready for final testing prior to the arrival of the CxA. If the CxA, CxM, or CxE arrive on-site for FPT's and it becomes evident that some or all systems are not ready for final testing (i.e., other than minor operational issues, equipment and systems do not perform as expected when going through the various control sequences), the tests will be considered "failed." The Owner reserves the right to deduct from the Contract Amount the costs to the Owner for re-testing for failed tests.

G. Problem Solving: The CxA will recommend solutions to problems found. However, the burden of responsibility to solve, correct, and retest problems is with the Contractor.

3.6 DOCUMENTATION, NON-CONFORMANCE, AND APPROVAL OF TESTS

- A. Documentation: The CxA, CxM, or CxE shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the Contractor for review. The CxA will include the filled-out forms in the final commissioning report.
- B. Non-Conformance
 - 1. The CxA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the Owner on a standard non-compliance form.
 - 2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form.
 - 3. Every effort will be made to expedite the testing process and minimize unnecessary de- lays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the Owner.
 - 4. As tests progress and a deficiency is identified, the CxA discusses the issue with the Contractor.

- a. When there is no dispute on the deficiency and the Contractor accepts responsibility to correct it:
 - The CxA documents the deficiency and the Contractor's response and intentions and they go on to another test or sequence. The deficiency is added to the Issue Log. A copy is provided to the Contractor and CxA. The Contractor corrects the deficiency, signs the Issue Log correction certifying that the equipment is ready to be retested and sends it back to the CxA.
 - 2) The CxA reschedules the test and the test is repeated.
- b. If there is a dispute about a deficiency regarding whether it is a deficiency or who is responsible:
 - The deficiency shall be documented on the non-compliance form with the Contractor's response and a copy given to the Owner and to the A/E.
 - Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the Owner. Final acceptance authority is also with the Owner.
 - 3) The CxA documents the resolution process.
 - 4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non- compliance form, and provides it to the CxA. The CxA reschedules the test and the test is repeated until satisfactory performance is achieved.
- 5. Cost of Retesting
 - a. The cost of retesting will be allocated in accordance with the General Conditions of the Contract.
- 6. The Contractor shall respond in writing to the CxA and Owner at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
- 7. The CxA retains the original non-conformance forms until the end of the project.
- 8. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension.
- C. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered

unacceptable by the Owner. In such case, the Contractor shall provide the Owner with the following:

- 1. Within one week of notification from the Owner, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the Owner within two weeks of the original notice.
- 2. Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
- 3. The Owner will determine whether a replacement of all identical units or a repair is acceptable.
- 4. Two examples of the proposed solution will be installed by the Contractor, and the Owner will be allowed to test the installations for up to one week, upon which the Owner will decide whether to accept the solution.
- 5. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
- D. Approval: The CxA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CxA and by the Owner. The CxA recommends acceptance of each test to the Owner using a standard form. The Owner gives final approval on each test using the same form, providing a signed copy to the CxA and the Contractor.

3.7 OPERATION AND MAINTENANCE MANUALS

- A. Standard O&M Manuals
 - 1. The specific content and format requirements for the standard O&M manuals are detailed in Section 01 77 00.
- B. Commissioning Report
 - 1. The CxA is responsible to compile, organize, and index the following commissioning data by equipment into labeled, indexed, and tabbed electronic media and deliver it to the Owner. The format of the manuals shall be:
 - a. Executive Summary
 - b. Cx Meeting Minutes
 - c. Commissioning Specifications
 - d. Commissioning Plan
 - e. Issue Log

- f. Commissioning Forms (Pre-functional Test forms, Functional Performance Test Forms and Trend Log)
- g. Equipment Start-up Reports
- h. Training Reports
- i. Additional Forms and Reports (TAB Report, BAS Point-to Point Check List, As- Built Control Drawings, O&M Manuals).

3.8 DEFERRED TESTING

- A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition, or other deficiency, execution of checklists and functional testing may be delayed upon approval of the Owner. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.
- B. Seasonal Testing: During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) specified in Section 23 08 00 shall be completed as part of this contract. The CxA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the Contractor, with PM facilities staff and the CxA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing will be made.

3.9 WRITTEN WORK PRODUCTS

A. The commissioning process generates a number of written work products described in various parts of the Specifications. The Commissioning Plan—Construction Phase, lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them, and the location of the specification to create them. In summary, the written products are as follows:

Product

Developed By

1.	Final commissioning plan	CxA
2.	Meeting minutes	CxA
3.	Commissioning schedules	CxA with GC and PM
4.	Equipment documentation submittals	GC
5.	Sequence clarifications	GC and A/E as needed
6.	Pre-functional checklists	CxA
7.	Startup and initial checkout plan	GC and CxA (compilation of
		existing documents)
8.	Startup and initial checkout	GC forms filled out
9.	Final TAB report	TAB
10	Issues log (deficiencies)	CxA
11.	Commissioning Progress Record	CxA
12.	Deficiency reports	CxA
13.	Functional test forms	CxA
14.	Final commissioning report	CxA

END OF SECTION 01 91 13

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Building demolition .
- B. Selective demolition of built site elements.
- C. Selective demolition of building elements for alteration purposes.
- D. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

A. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 Safety and Health Regulations for Construction Current Edition.
- B. NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
 - 1. Vegetation to be protected.
 - 2. Areas for temporary construction and field offices.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

- A. Remove the entire buildings the two existing metal buildings shall be removed in their entirety including all foundations, etc..
- B. Remove portions of existing building as required by new consruction.

- 1. see drawings.
- C. Remove paving and curbs as required to accomplish new work.
- D. Visit site prior to bid and verify all existing conditions, existing structures, finishes, and location of work area.
- E. Remove concrete slabs on grade as required for new work..
- F. Remove fences and gates.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Use of explosives is not permitted.
 - 3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 4. Provide, erect, and maintain temporary barriers and security devices.
 - 5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 7. Do not close or obstruct roadways or sidewalks without permit.
 - 8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
 - 10. Buildings Occupancy: The building will be occupied. Work may be accomplished during normal hours. Notify the owner 48 hours in advance if any demolition will result in excessive noise or vibration which may be sensed in the area. Contractor to seal off all work areas and maintain fire exiting for the building.
- B. Do not begin removal until receipt of notification to proceed from Owner.

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- C. Protect existing structures and other elements that are not to be removed (including adjacent builings).
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
- D. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- E. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

3.03 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as shown.
 - 2. Report discrepancies to Architect before disturbing existing installation.

- 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
 - 2. Remove items indicated on drawings.
- C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.
 - 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- D. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch as specified for patching new work.

3.05 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.
- D. All demolished materials shall become the property of the Contractor and shall be removed from the site by the Contractor unless noted otherwise in Contract Documents.

- E. The Contractor shall select haul routes, obtain required approval of local authorities, and conduct its operations in such manner as to insure minimum interference with roads, street, sidewalks, and neighboring buildings and facilities and so that there is no interference with the normal operations of the building.
- F. The Contractor shall obtain all necessary permits and comply with all statutes, ordinances, codes and regulations applicable to the work to be performed.
- G. The Contractor shall take all precautions necessary to assure that the work will be performed in a manner that will not endanger the public, any workman, or any property in the vicinity of the work.
- H. The Contractor shall take such actions as shall be necessary to assure that members of the public will have safe passage on the public streets around the area of demolition, and construct such fencing, barricades and obstacles as will prevent unauthorized entry to the work site.

END OF SECTION

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PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies cast-in-place concrete, including reinforcement, concrete materials, mix design, placement procedures, and finishes.
- B. Related Sections include the following:
 - 1. Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.

1.03 SUBMITTALS

- A. General: In addition to the following, comply with submittal requirements in ACI 301.
- B. Product Data: For each type of manufactured material and product indicated.
- C. Design Mixes: For each concrete mix.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- C. Source Limitations: Obtain each type of cement of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- D. Comply with ACI 301, "Specification for Structural Concrete," including the following, unless modified by the requirements of the Contract Documents.
 - 1. General requirements, including submittals, quality assurance, acceptance of structure, and protection of in-place concrete.
 - 2. Formwork and form accessories.

- 3. Steel reinforcement and supports.
- 4. Concrete mixtures.
- 5. Handling, placing, and constructing concrete.

PART 2 PRODUCTS

2.01 FORMWORK

A. Furnish formwork and form accessories according to ACI 301.

2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Wire: ASTM A 82, as drawn.
- C. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, not exceeding 1-1/2-inch (38-mm) nominal size.
- C. Water: Potable and complying with ASTM C 94.

2.04 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- E. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.05 RELATED MATERIALS

A. Plastic Vapor Retarder - Equal to W.R. Meadows 15 mil Perminator

- Performance-Based Specification: Vapor retarder membrane shall be manufactured from virgin polyolefin resins, and when tested according to all requirements of ASTM E1745, shall meet the following minimum performance requirements:
- Maximum Water Vapor Permeance (ASTM E154 Sections 7, 8, 11, 12, 13, by ASTM E96, Method B or ASTM F1249)
- 3. As received: 0.0063 perms. ii After Wetting and Drying: 0.0052 perms.
- 4. Resistance to Plastic Flow and Temperature: 0.0057 perms.
- 5. Effect Low Temperature and Flexibility: 0.0052 perms
- 6. Resistance to Deterioration from Organisms and Substances in Contacting Soil: 0.0052 perms.
- 7. Puncture Resistance (ASTM D1709): >3,200 grams.
- 8. Tensile Strength ASTM E154, Section 9: 72 Lb. Force/Inch
- B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.06 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlappolyethylene sheet.
- D. Water: Potable.
- E. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

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H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.07 CONCRETE MIXES

- A. Comply with ACI 301 requirements for concrete mixtures.
- B. Prepare design mixes, proportioned according to ACI 301, for normal-weight concrete determined by either laboratory trial mix or field test data bases, as follows:
 - 1. Compressive Strength (28 Days): As indicated on drawings, but in no case less than 3000 PSI or for mud sills no less than 2500 PSI if required.
 - 2. Slump: 4 inches (100 mm).
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2.5 to 4.5 percent.
 - 1. Air content of trowel-finished interior concrete floors shall not exceed 3.0 percent.

2.08 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with ASTM C 94 and ASTM C 1116.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 FORMWORK

A. Design, construct, erect, shore, brace, and maintain formwork according to ACI 301.

3.02 VAPOR RETARDER

- A. Install, protect, and repair vapor-retarder sheets according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.
- B. Install per Manufacturers instructions.
- C. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.03 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

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1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.04 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Locate and install so as not to impair strength or appearance of concrete, at locations indicated or as approved by Architect.
- C. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
- D. Contraction (Control) Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
 - Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a radius of 1/8 inch (3 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

3.05 CONCRETE PLACEMENT

- A. Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.
- B. Do not add water to concrete during delivery, at Project site, or during placement.
- C. Consolidate concrete with mechanical vibrating equipment.

3.06 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch (6 mm) in height rubbed down or chipped off.

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- 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Completely remove fins and other projections.
 - 1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 - 2. Apply the following rubbed finish, defined in ACI 301, to smooth-formed finished concrete.
 - a. Smooth-rubbed finish.
 - b. Grout-cleaned finish.
 - c. Cork-floated finish.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.07 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on the surface.
 - 1. Do not further disturb surfaces before starting finishing operations.
- C. Scratch Finish: Apply scratch finish to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finish, unless otherwise indicated.
- D. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- E. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with Clear Sealer, resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

- F. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- G. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.08 TOLERANCES

A. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

3.09 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection, and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure formed and unformed concrete for at least seven days by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

- Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Tests will be performed according to ACI 301.
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.

3.11 REPAIRS

A. Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete Block.
- B. Mortar and Grout.
- C. Reinforcement and Anchorage.
- D. Lintels.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 Metal Fabrications: Loose steel lintels.
- B. Section 07 2100 Thermal Insulation: Insulation for cavity spaces.
- C. Section 07 8401 Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.
- D. 07 2500 Weather Barriers
- E. Section 07 6200 Sheet Metal Flashing and Trim: Through-wall masonry flashings.
- F. Section 07 8400 Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.
- G. Section 07 9200 Joint Sealants: Sealing control and expansion joints.
- H. Section 07 9005 Joint Sealers: Backing rod and sealant at control and expansion joints.
- I. Section 07 6500 Wall Flashing

1.03 REFERENCE STANDARDS

- A. TMS 402/602 Building Code Requirements and Specification for Masonry Structures 2016.
- B. ACI 530.1/ASCE 6/TMS 602 Specification For Masonry Structures; American Concrete Institute International; 2008.
- C. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

- D. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.
- E. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- F. ASTM C90 Standard Specification for Loadbearing Concrete Masonry Units 2016a.
- G. ASTM C91/C91M Standard Specification for Masonry Cement 2018.
- H. ASTM C129 Standard Specification for Nonloadbearing Concrete Masonry Units 2017.
- I. ASTM C140/C140M Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units 2021.
- J. ASTM C150/C150M Standard Specification for Portland Cement 2021.
- K. ASTM C270 Standard Specification for Mortar for Unit Masonry 2019a.
- L. ASTM C404 Standard Specification for Aggregates for Masonry Grout 2018.
- M. ASTM C476 Standard Specification for Grout for Masonry 2020.
- N. ASTM C780 Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry 2020.
- O. UL (FRD) Fire Resistance Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Samples: Submit 2 samples of Concrete Masonry Units units to illustrate color, texture, and extremes of color range.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of the contract documents.
- B. Fire Rated Assemblies: Conform to applicable code for [_____] requirements for fire rated masonry construction.
- C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 MOCK-UP

- A. Construct a masonry wall as a mock-up panel sized as indicated on drawings; include mortar and accessories, structural backup, wall openings, flashings, and wall insulation in mock-up.
- B. Locate where directed.
- C. Mock-up may not remain as part of the Work.
- D. Refer to section 01 4000.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 x 8 inches (400 x 200 mm) and nominal depths as indicated on the drawings for specific locations.
 - 2. Special Shapes: Provide non-standard blocks configured for corners.
 - 3. Load-Bearing Units: ASTM C90, normal weight.

- a. Hollow block, as indicated.
- b. Exposed Faces: Manufacturer's standard color and texture where indicated.
- 4. Non-Loadbearing Units: ASTM C129.
 - a. Hollow block.

2.02 BRICK UNITS

2.03 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
 - 1. Grout Aggregate: ASTM C404.
 - a. Color(s): as selected by Architect and Owner from manufacturer's full range..

2.04 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers of Joint Reinforcement and Anchors:
 - 1. Blok-Lok Limited; [____]: www.blok-lok.com/#sle.
 - 2. Hohmann & Barnard, Inc; 2-Seal Tie: www.h-b.com/#sle.
 - 3. Dur-O-Wal: www.dur-o-wal.com.
 - 4. Hohmann & Barnard, Inc (including Dur-O-Wall brand): www.h-b.com.
 - 5. WIRE-BOND: www.wirebond.com/#sle.
 - 6. Substitutions: See Section 01 6000 Product Requirements.
- B. Reinforcing Steel: ASTM A615/A615M Grade 60 (420) deformed billet bars.
- C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated. Size to provide not more than 1 inch (25 mm) and not less than 1/2 inch of mortar coverage from masonry face. Some coursing may not align and will need 2 parts.
- D. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage from masonry face.
 - Concrete frame: Dovetail anchors of bent steel strap, nominal 1 inch (25 mm) width x 0.024 in (0.61 mm) thick, with trapezoidal wire ties 0.1875 inch (4.75 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

- 2. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch (6.3 mm) thick, with trapezoidal wire ties 0.1875 inch (4.75 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
- E. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
 - 1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 - 2. Wire ties: Manufacturer's standard shape, 0.1875 inch (4.75 mm) thick.
 - 3. Vertical adjustment: Not less than 3-1/2 inches (89 mm).

2.05 FLASHINGS

- A. Metal Flashing Materials: [_____], as specified in Section 07 6200.
- B. Thru Wall Flashing Refer to Division 07.

2.06 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
 - 1. Manufacturers:
 - a. Dur-O-Wal: www.dur-o-wal.com.
 - b. Hohmann & Barnard, Inc (including Dur-O-Wal brand); [____]: www.h-b.com/#sle.
 - c. WIRE-BOND: www.wirebond.com/#sle.
 - d. Substitutions: See Section 01 6000 Product Requirements.
- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; maximum lengths available.
- C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
 - 1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
 - a. Manufacturers:

- Advanced Building Products Inc; Mortar Break: www.advancedflashing.com/#sle.
- Mortar Net Solutions; Mortar Net with Insect Barrier: www.mortarnet.com/#sle.
- 3) Substitutions: See Section 01 6000 Product Requirements.
- D. Termination Bars: Stainless steel; compatible with membrane and adhesives.
- E. Drip Edge: Stainless steel; compatible with membrane and adhesives.
- F. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.
- G. Weeps:
 - PVC cellular Hahmann & Barnard Quadro-Vent Honeycomb Design 3/8" x 2-1/2" x 3-3/8" or approved equal. This is to be used at cast stone as well; adust size to accomodate cast stone.
- H. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
- I. Where truss reinforcement is specified, provide prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.
- J. Stainless Steel Termination Bar install continuous termination bar refer to Section 07 6500.

2.07 MORTAR AND GROUT MIXES

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
 - 1. Masonry below grade and in contact with earth: Type S.
 - 2. Exterior, loadbearing masonry: Type S.
 - 3. Exterior, non-loadbearing masonry: Type S.
 - 4. Interior, loadbearing masonry: Type S.
- B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
- C. Grout: ASTM C476. Consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm)

or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm). Provide 28 day compressive strength indicated on drawings.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running, match existing
 - 2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
 - 3. Mortar Joints: Concave., match existing
- D. Brick Units:

- 1. Bond: Running, match existing.
- 2. Coursing: Three units and three mortar joints to equal 8 inches (200 mm).
- 3. Mortar Joints: match existing.

3.05 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Interlock intersections and external corners, except for units laid in stack bond.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 WEEPS/CAVITY VENTS

- A. Install weeps in veneer and cavity walls at 24 inches (600 mm) on center horizontally above through-wall flashing, above shelf angles and lintels, at bottom of walls, and at top of walls for ventilation.
- B. Do not cover up weeps with soil or landscaping material.

3.07 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
C. Install cavity mortar control panels continuously throughout exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions. Verify that airspace width is no more than 3/8 inch (9 mm) greater than panel thickness. Install horizontally between joint reinforcement. Stagger end joints in adjacent rows. Fit to perimeter construction and penetrations without voids.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
- C. Lap joint reinforcement ends minimum 6 inches (150 mm).
- D. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches (900 mm) horizontally and 24 inches (600 mm) vertically.
- E. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

3.09 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

- A. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
- B. Lap joint reinforcement ends minimum 6 inches (150 mm).

3.10 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
- C. Lap joint reinforcement ends minimum 6 inches (150 mm).
- D. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches (400 mm) on center vertically and 36 inches (900 mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.
- E. Masonry Back-Up: Provide continuous masonry reinforcing at 16" O.C. unless otherwise specified

- F. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16" on center vertically and horizontally. Place additional anchors at perimeter of openings and ends of panels so maximum spacing of anchors is 8 inches on center.
- G. Install masonry veneer anchorage after installation and acceptance of air barrier systems. Reinstall air barrier on top of masonry veneer anchors prior to installation of masonry veneer. Refer to 07 2500 Weather Barriers.

3.11 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 - 1. Extend flashings full width at such interruptions and at least 6 inches (152 mm) into adjacent masonry or turn up at least 8 inches (203 mm) to form watertight pan at non-masonry construction.

3.12 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.13 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
 - 1. Fill adjacent masonry cores with grout minimum 12 inches (300 mm) from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

3.14 TOLERANCES

- A. Maximum Variation from Alignment of Columns: 1/4 inch (6 mm).
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).

- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
- D. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).
- F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.15 CUTTING AND FITTING

- A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.16 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 Quality Requirements.
- B. Concrete Masonry Unit Tests: Contractor to provide test of each variety of concrete unit masonry in accordance with ASTM C140/C140M for conformance to requirements of this specification.
- C. Mortar Tests: Contractor to provide test of each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.17 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.18 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

Northport FMS #9 Renovations Northport, AL END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 Rough Carpentry: Wood blocking and miscellaneous framing.
- B. Section 07 2100 Thermal Insulation: Insulation within framing members.
- C. Section 09 2116 Gypsum Board Assemblies: Lightweight, non-load bearing metal stud framing.
- D. Section 09 2300 Gypsum Plastering.

1.03 REFERENCE STANDARDS

- A. AISI S100-12 North American Specification for the Design of Cold-Formed Steel Structural Members 2012.
- B. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM C955 Standard Specification for Cold-Formed Steel Structural Framing Members 2018, with Editorial Revision.
- D. ASTM C1007 Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories 2020.
- E. SSPC-Paint 20 Zinc-Rich Coating (Type I Inorganic, and Type II Organic) 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations and [].
- C. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention, and [].
- D. Provide shop drawings of metal stud, joist and bridging. Provide all details.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing:
 - 1. CEMCO; [____]: www.cemcosteel.com/#sle.
 - 2. Clarkwestern Dietrich Building Systems LLC; [____]: www.clarkdietrich.com.
 - 3. Marino; [____]: www.marinoware.com/#sle.
 - 4. Substitutions: See Section 01 6000 Product Requirements.
- B. Framing Connectors and Accessories:
 - 1. Same manufacturer as metal framing.
 - 2. Simpson Strong Tie; [____]: www.strongtie.com/#sle.

2.02 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, stiffners, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.03 FRAMING MATERIALS

- A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
 - 1. Gage and Depth: As indicated on drawings.
- B. Framing Connectors: Factory-made, formed steel sheet.
 - 1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with galvanized coating for base metal thickness less than 10 gage, 0.1345 inch (3.42 mm), and factory punched holes and slots.
 - 2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.

3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.04 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Plates, Gussets, Clips: Formed Sheet Steel, [___] inch ([___] mm) thickness; finish to match framing components.
- C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.05 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
- B. Anchorage Devices: Powder actuated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION OF STUDS

- A. Install components in accordance with ASTM C1007 requirements and ASTM C1007 requirements.
- B. Place studs at 16 inches (400 mm) maximum, unless stated otherwise, on center; not more than 2 inches (50 mm) from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method.

END OF SECTION

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PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel items.
- B. Bollards

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 09 9000 Painting and Coating: Paint finish.

1.03 REFERENCE STANDARDS

- A. ANSI A14.3 American National Standard for Ladders -- Fixed -- Safety Requirements 2018.
- B. ASTM A36/A36M Standard Specification for Carbon Structural Steel 2019.
- C. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
- D. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- E. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- F. ASTM A283/A283M Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- G. ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- H. ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2010.
- I. ASTM A500/A500M Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- J. ASTM A501/A501M Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.

- K. ASTM A1011/A1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- L. AWS A2.4 Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.
- M. AWS D1.1/D1.1M Structural Welding Code Steel 2020.
- N. SSPC-SP 2 Hand Tool Cleaning 2018.

1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."

1.06 PROJECT CONDITIONS

- A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.07 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500 Grade B cold-formed structural tubing.
- C. Plates: ASTM A 283.
- D. Pipe: ASTM A 53/A 53M Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A 653 Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Wide Flange Sections: ASTM A992
- H. Fasteners:
 - 1. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.
 - 2. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
 - 3. Anchor Bolts: ASTM F 1554, Grade 36.
 - 4. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
 - 5. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
 - 6. Plain Washers: Round, carbon steel, ASME B18.22.1 (ASME B18.22M).
 - Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1 (ASME B18.21.2M).
 - 8. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load

imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

- a. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
- 9. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.
- I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

- A. Hot Dipped Galvanized Guard Rail
- B. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; hot dipped prime paint finish.

2.04 GROUT

- A. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.05 FINISHES - STEEL

- A. Prepare surfaces to be primed in accordance with SSPC-SP2.
- B. Clean surfaces of rust, scale, grease, and foreign matter prior to galvanizing.
- C. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.
- D. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.06 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
- D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Perform field welding in accordance with AWS D1.1/D1.1M.
- D. Obtain approval prior to site cutting or making adjustments not scheduled.
- E. After erection, prime welds, abrasions and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

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- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concealed blocking for miscellaneous items.
- B. Preservative treated wood materials.
- C. Communications and electrical room mounting boards.
- D. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 05 5000 Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
- C. Section 07 6200 Sheet Metal Flashing and Trim: Sill flashings.
- D. Section 09 2116 Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- B. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- C. ASTM D2898 Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing 2010 (Reapproved 2017).
- D. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- E. AWPA U1 Use Category System: User Specification for Treated Wood 2018.
- F. PS 1 Structural Plywood 2009 (Revised 2019).
- G. PS 20 American Softwood Lumber Standard 2020.
- H. SPIB (GR) Grading Rules 2014.

1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials and application instructions.
- C. Samples: For rough carpentry members that will be exposed to view, submit two samples, 6x6 inch ([___]x___ mm) in size illustrating wood grain, color, and general appearance.
- D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Southern Pine, unless otherwise indicated.
 - 2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.

2. Boards: Standard or No. 3.

2.03 EXPOSED DIMENSION LUMBER

- A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).
- B. Sizes: Nominal sizes as indicated on drawings.
- C. Surfacing: S4S.
- D. Sizes: Nominal sizes as indicated on drawings, S4S.
- E. Moisture Content: S-dry or MC19.

2.04 EXPOSED BOARDS

- A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.
- B. Moisture Content: Kiln-dry (15 percent maximum).
- C. Surfacing: S4S.
- D. Species: Douglas Fir.
- E. Grade: No. 2, 2 Common, or Construction.

2.05 CONSTRUCTION PANELS

- A. Wall Sheathing, 5/8": Plywood, PS 1, Grade A-C, Exterior Exposure. see drawings for thickness of panels. Exposed side A facing with no blemishes or patches.
- B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.06 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 - 2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

2.07 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- E. Specifically, provide the following non-structural concealed framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.

- 7. Chalkboards and marker boards.
- 8. Joints of rigid wall coverings that occur between studs.
- 9. Interior Wall Plaques
- 10. Acoustical Wall Panels.
- 11. Audio/Visual Equipment
- 12. Uniform Storage and Instrument Storage Cabinets.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.05 INSTALLATION OF CONSTRUCTION PANELS

- A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
- B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.
 - 4. Size and Location: As indicated on drawings.

3.06 TOLERANCES

- A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
- B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.07 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 01 7419.
 - 1. Comply with applicable regulations.

- 2. Do not burn scrap on project site.
- 3. Do not burn scraps that have been pressure treated.
- 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to cogeneration facilities or "waste-to-energy" facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

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PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items and misc. wood trim.
- B. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI (AWS) for Premium Grade.

2.02 WOOD-BASED COMPONENTS

Wood fabricated from old growth timber is not permitted.

2.03 LUMBER MATERIALS

A. Hardwood Lumber: poplar species, maximum moisture content of 6 percent; with vertical grain, of quality suitable for opaque finish.

2.04 SHEET MATERIALS (refer to Section 06 1000 Rough Carpentry)

Northport FMS #9 Renovations Northport, AL

A. Installation for sheet and panel materials is in this Section 06 2000 and Section 06 1000.

2.05 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Fasteners: Of size and type to suit application; project finish in concealed locations and project finish in exposed locations.
- C. Concealed Joint Fasteners: Threaded steel.

2.06 ACCESSORIES

A. Wood Filler: Solvent base, tinted to match surface finish color.

2.07 HARDWARE - As specified in Section _____.

A. Hardware: Comply with BHMA A156.9.

2.08 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.
- C. See Section 06 1000 Rough Carpentry for installation of recessed wood blocking.

3.02 INSTALLATION

- A. Set and secure materials and components in place, plumb and level.
- B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.
- C. Install hardware in accordance with manufacturer's instructions.

3.03 TOLERANCES

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- A. Maximum Variation from True Position: 1/16 inch (1.6 mm).
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION

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PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Countertops (Plastic Laminate)
- C. Wood Trim
- D. Cabinet hardware.
- E. Plastic Laminate Casework

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 06 1000 Rough Carpentry: Support framing, grounds, and concealed blocking.
- C. Seciton 06 2000 Finished Carpentry.
- D. Section 09 6500 Resilient Base

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 American National Standard for Particleboard; 2009.
- B. ANSI A208.2 American National Standard for Medium Density Fiberboard for Interior Use; 2009.
- C. BHMA A156.9 American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).
- D. GSA CID A-A-1936 Adhesive, Contact, Neoprene Rubber; Federal Specifications and Standards; Revision A, 1996.
- E. NEMA LD 3 High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.
- F. AWI/AWMAC/WI (AWS) Architectural Woodwork Standards; 2014

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

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- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Minimum Scale of Detail Drawings: 1-1/2 inch to 1 foot (1:8).
- C. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
- D. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.08 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

- A. Plastic Laminate Faced Cabinets: Custom grade.
- B. Cabinets:
 - 1. Finish Exposed Exterior Surfaces: Decorative laminate.
 - 2. Finish Exposed Interior Surfaces: Decorative laminate.
 - 3. Finish Concealed Surfaces: Manufacturer's option.
 - 4. Door edges, Drawer edges, Front of cabinet edges, Shelves edges, and Cabinet Face Profiles: 3 mm thick, factory adhered. Provide minimum 24 color options.

- 5. Casework Construction Type: Type A Frameless.
- 6. Interface Style for Cabinet and Door: Style 1 Overlay; reveal overlay.
- 7. Cabinet Design Series: As indicated on drawings.
- 8. Adjustable Shelf Loading: 50 lbs. per sq. ft..
 - a. Deflection: L/144.
- 9. Cabinet Style: Flush overlay.
- 10. Cabinet Doors and Drawer Fronts: Flush style.
- 11. Drawer Side Construction: Provide a four sided drawer box that is made of 1/2 inch thick industrial particle board; finish same as semi exposed. Provide doweled and glued joints and 1/2 inch thick mechanically fastened bottom. Provide plastic laminate drawer face with EMM PVC edging. Blind screw front of draw box into plastic laminate drawer face.

2.02 SOLID WOOD TRIM COMPONENTS:

A. Softwood Lumber for Opaque Finish: B or better species; maximum mositure content of 6 percent; with vertical grain, of quality for opaque finish. No finger joints.

2.03 LAMINATE MATERIALS

- A. Manufacturers: per architects selection (any standard or premium laminate)
 - 1. Formica Corporation: www.formica.com.
 - 2. Panolam Industries International, Inc: www.nevamar.com.
 - 3. Wilsonart, LLC: www.wilsonart.com.
 - 4. Substitutions: See Section 01 6000 Product Requirements.
- B. Thermally Fused Laminate (TFL): NEMA LD 3, Type VGL laminate panels.
- C. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- D. Provide specific types as scheduled.
 - 1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, colors as scheduled, finish as scheduled. Colors as selected by Architect.
 - 2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, colors as scheduled, finish as scheduled. Colors as slected by Architect.

- 3. Cabinet Liner: CLS, 0.020 inch (0.51 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
- 4. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.04 SHEET MATERIALS

- A. Softwood plywood, not exposed to view: any face series, plywood core; PS 1 Grade A-B, glue type as recommended for application.
- B. All veneers to be factory fused to plywood core by manufacturer.
- C. Hardboard: ANSI A135.4; Pressed wood fiber with resin binder, Class 1 -Tempered, 1/4" thick, smooth one side (SIS).
- D. Opaque Finish or transparent interior sheet:
 - 1. Birch, 3/4" thick, plain sliced premium gradeadhered to core oer applicable codes and regulations.
 - 2. Class A with flame spread of 25 or less; smoke development of 0-450.

2.05 COUNTERTOPS

A. Plastic Laminate Countertops: Medium density fiberboard substrate covered with HPDL, conventionally fabricated, with decorative 1 5/16 inch high x 3mm thick (typical) edge and laminate backer.

2.06 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self-locking serrated tongue; of width to match component thickness.
 - 1. Color: As selected by Architect from manufacturer's standard range (the intent is to match the adjoining plastic laminate as closely as possible).
 - 2. Use at 3mm at all cabinet faces, doors, drawer fronts, and exposed edges.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- D. Concealed Joint Fasteners: Threaded steel.

- E. Grommets: Stainless steel grommets for cut-outs. For bidding purposes, calculate at least one per individual work surface unless noted otherwise. The actual locations must be approved by architect.
- F. Counter top bracket supports: Painted steel, per manufactures standard, comply with ADA

2.07 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.
- C. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers, ADA compliant
- D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
- E. Drawer Slides:
 - 1. Type: Full extension.
 - 2. Static Load Capacity: Commercial grade.
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
 - 5. Features: Provide self closing / soft close / stay closed type. (provide actual guide in mock up cabinet)
 - 6. Products:
 - a. Accuride International, Inc: www.accuride.com.
 - b. Grass America Inc: www.grassusa.com.
 - c. Hettich America, LP: www.hettichamerica.com.
 - d. Knape & Vogt Manufacturing Company: www.knapeandvogt.com.
 - e. Substitutions: See Section 01 6000 Product Requirements.

- F. Hinges: five knuckle -, BHMA No. <u>A156.9</u>, epoxy powder coated steel finish in manufacturers colors as slected by architect; 09 inches thick minimum, instutional grade. Doors over 48 inches in height shall have a minimum of three hinges, less than height shall have two hinges.
- G. Door Catches: magnetic door cates in number required to hold doors in closed position.
- H. Pilaster standards and shelf clips for adjustable shelves. Match color of cabinet interior. Recess into cabinet sides or Contractor's option to provide injection moulded clear plastic shelf clips with a double pin engagement at 32 mm on center. Shall have 3/4 inch anti-tip locking tabs.

2.08 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet (600 mm) from sink cut-outs.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
- E. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Seal cut edges.
- F. The architectural casework wood contractor shall coordinate their manufacturing and installation to accomodate the plumbing, mechanical, electrical, and countertops for all requirements to comple tethe project installation to include but not limited to sinks, pips, conduit, troughs, outlets, receptacles, etc., as specified and or shown on Contract Documents. Job verify all wall and floro conditions prior to fabrication; make adjustments per architects prior written approval.

2.09 MANUFACTURERS/PRODUCTS:

- A. Acceptable Products: Custom Grade per AWI
 - 1. Stevens Industries
 - 2. Case Systems

- 3. Alco Enterprise, Inc. Montgomery, AL
- 4. Phipps Cabinets, Inc Dothan, AL
- 5. Cahalan Woodworks Moody, AL
- 6. TMI Cabinets
- 7. Substitutions: See 01 6000 Product Requirements
- 8. All listed must meet all other requirments in this specification.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.
- C. Verify all existing conditions prior to completing shop drawings and fabrication.

3.02 INSTALLATION

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (1 mm). Do not use additional overlay trim for this purpose.
- E. Secure cabinets to floor using appropriate angles and anchorages.
- F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

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PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, and downspouts.
- B. Sealants for joints within sheet metal fabrications.
- C. Gutters and Downspouts.
- D. Precast concrete splash pads.

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 Joint Sealers.
- B. Section 13 3410 Metal Building Systems.
- C. Section 09 9000 Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- B. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- C. ASTM C920 Standard Specification for Elastomeric Joint Sealants 2018.
- D. ASTM D4586/D4586M Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- E. SMACNA (ASMM) Architectural Sheet Metal Manual 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples 6 x 6 inch (<u>x</u> mm) in size illustrating metal finish color.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with CDA A4050 and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Maintain one copy of each document on site.
- C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.07 MOCK UP

A. Refer to 01 4000 Quality Requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

1.09 PRE-ROOFING MEETING:

- A. Organize and conduct a meeting at the construction site 2 weeks before scheduled start of roof system installation with roofing installer; installer of each component of related work, including deck or substrate construction, roof equipment, penetrations of roof deck, and other work integral with or adjacent to roofing; the architect; the Owner; the local code inspector, roofing manufacturer's representative; approved roofing consultant; owner's construction manager; and other parties involved with roofing system performance, including owner's insurance representative, independent testing agencies, and governing authorities.
 - 1. Walk roof areas to review and discuss substrate preparation including repair of unacceptable surfaces, roof drainage, penetrations, equipment curbs, and work performed by other trades which requires coordination with roofing system.
 - 2. Examine steel deck for proper flatness and slope, review structural capability for supporting roofing system and methods of fastening.
 - 3. Review contract document requirements and submittals for roofing system, including roofing schedule, inspection and testing, and environmental conditions. Identify what are considered unacceptable weather conditions for roofing, and which governing regulations or insurance requirements will affect roofing system installation.

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4. Document discussions in writing, including actions required, and distribute copy of reports to each meeting participant.

1.10 WARRANTIES:

- A. Manufacturer's finish warranty:
 - 1. Covering bare metal against rupture, structural failure and perforation due to normal atmospheric corrosion exposure.
 - 2. Covering panel finish against cracking, checking, blistering, peeling, flaking, chipping, chalking and fading.
 - 3. Duration: twenty (20) years

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 guage thick base metal, shop pre-coated with PVDF coating.
 - 1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system. Provide manufacturer's standard prime coat on underside.
 - 2. Color: As selected in writing by Architect & Owner from manufacturer's full colors.

2.02 ACCESSORIES

- A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.
- B. Underlayment: Self Adhered Underlayment Equal to Grace Ultra
- C. Primer: As recommended by manufacturer for application and specified finish.
- D. Protective Backing Paint: Asphaltic mastic, ASTM D 4479 Type I.
- E. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.
- F. Sealant to be Exposed in Completed Work: {\rs\#1}; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.
- G. Sealant: Type II specified in Section 07 9005.
- H. Plastic Cement: ASTM D4586, Type I.

- I. Gutters and downspouts, per SMACNA, size as required by Region.
 - 1. Coordinate downspouts with Civil requirements in regard to downspout boots and storm drainage system.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet, minimum 1 inches ([___] mm) wide, interlocking with sheet. Provide continuous cleats where indicated on drawings and/or recommended by SMACNA.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- F. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.
- G. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.
- H. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.04 GUTTER AND DOWNSPOUT FABRICATION

- A. Gutters: SMACNA (ASMM) Rectangular profile.
- B. Downspouts: Rectangular profile.
- C. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM).
- D. Accessories: Profiled to suit gutters and downspouts.
 - 1. Anchorage Devices: In accordance with SMACNA requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Brackets.
- E. Seal metal joints.

PART 3 EXECUTION
3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

- A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- B. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- C. Seal metal joints watertight.
- D. Set splash pads under downspouts.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 Quality Requirements, for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.
- B. Section 04 2000 Unit Masonry
- C. Section 07 2500 Weather Barriers
- D. Section 07 6000 Sheet Metal Flashing and Trim

1.02 SUMMARY

- A. Section provides for a flexible rubberized asphalt, self –sealing through-wall flashing and wall flashing, and stainless steel 26 gauge terminations at all dissimilar masonry transitions and general horizontal masonry drainage.
- B. Provide single source manufacturers for Section 07 2500 Weather Barrier, Section 07 6500 Wall Flashing, Termination Bars (refer to 04 2000), and termination bar sealants (refer to 07 9005) as required to ensure compatibly among all products installed as a part of the moisture control assembly at the exterior walls.
 - 1. Where single source cannot be provided, notify architect and provide written verification from manufacturers of all products intended for installation to ensure products from multiple manufacturers are compatible and all specified warranties can be provided and maintained in full force and effect for the entirety of the specified warranty periods for each product.
- C. In no case shall wall flashing be exposed to sun light. If drawings show the flashing exposed disregard. Wall flashing is <u>not</u> to be exposed to sun light.

1.03 REFERENCES

- A. American Society for Testing and Materials
 - 1. ASTM E 96 Test Methods for Water Vapor Transmission of Materials.
 - 2. ASTM D 570 Test method for Water Absorption of Plastics.
 - 3. ASTM E 154 Test Method for Water Vapor Retarders used in contract with Earth Under Concrete Slabs, on Walls or as Ground Cover.
 - 4. ASTM D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting.

- 5. ASTM D 1938 Test Method for Tear Propagations Resistance of Plastic Film and Thin Sheeting by a Single-Tear Method.
- 6. ASTM D 1876 Test Method for Peel Resistance of Adhesives.
- ASTM D 1970 Standard Specifications for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- 8. ASTM D 412 Test Methods for Vulcanized Rubber & Thermoplastic Rubbers and Thermoplastic Elastomers Tension.

1.04 SUBMITTALS

- A. Product Data and Shop Drawings: Submit for each product; Spec-Data®/Data Sheets, details and installation procedures.
- B. Test Reports: Indicating compliance with the performance requirements of this section.
- C. Samples of flashing.
- D. Mock-up: Refer to section 04 2000 Unit Masonry.
- E. Pre-installation meeting with Architect, Owner, Owners Waterproofing Consultant, Contractor's Construction Manager, Window or Storefront Supplier, Masonry Contractor, Flashing Manufacturer, Waterproofing Subcontractor and others associated with the work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations for storage and handling of each product.

1.06 WARRANTY

- A. Standard Product Warranty:
 - 1. Submit manufacturer's 5-year warranty at the end of this section, signed by the authorized General Contractor and the authorized Waterproofing Subcontractor.

PART 2 PRODUCTS

2.01 MATERIALS

A. Through Wall Flashing as referred to on drawings: Grace Perma-Barrier Wall Flashing, 40 mil total thickness, self-adhered flexible flashing. Provide mastic, adhesive, primers, seam tapes per manufacturers' instructions and specified warranties.

- B. Equal manufacturers shall be Heckman Building Products and Hohmann & Barnard, Inc.
- C. Equal manufacturers Dur-O-Wall- Duro-Barrier Thru Wall Flashing.
- D. Performance Requirements:
 - Water Vapor Transmission: ASTM E 96, Method B-2.9 ng/m2sPa (0.05 perms) maximum.
 - 2. Water Absorption: ASTM D 570 Max 0.1% by weight.
 - 3. Puncture Resistance: ASTM E 154 178 N (40 lbs.)
 - 4. Tear Resistance:
 - a. Initiation ASTM D 1004 min. 58 N (13.0 lbs) M.D.
 - b. Propagation ASTM D 1938 min. 40 N (9.0 lbs) M.D.
 - 5. Lap Adhesion at -4°C (25°F): ASTM D 1876 880 N/M (5.0 lbs./in.) of width
 - 6. Low Temperature Flexibility: ASTM D 1970 Unaffected to -43°C (-45°F).
 - a. Tensile Strength: ASTM D 412, Die C Modified Min. 5.5 MPa (800 psi)
 - Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D 412, Die C Min. 200%.
- E. Outside and inside corners per manufacturer.
- F. Flashing Weeps Mortar Nets, etc. Refer to Section 04 2000 "Unit Masonry" for additional installation requirements.
- G. Termination Bar
 - 1. Stainless Steel Flashing and Special Sections: Provide 26 gauge stainless steel flashing termination strips. Refer to flashing detail on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

 A. Examine conditions, with installer present, for compliance with requirements for installation, tolerances and other specific conditions affecting performance of flashing. Remove all deleterious materials from surfaces to be flashed.

3.02 INSTALLATION

- A. General: Install flashing to dry surfaces at air and surface temperatures of -4°C (25°F) and above in accordance with manufacturer's recommendations at locations indicated on Construction Documents.
- B. Through Wall Flashing Referred to on drawings as "Through Wall Flashing" or "Thru Wall Flashing": All flashing and accessories shall be installed in accordance with manufacturer's printed instructions, contract documents.
- C. Accessories:
 - 1. When required by dirty or dusty site conditions or by surfaces having irregular or rough texture, apply surface conditioner by spray, brush, or roller at the rate recommended by manufacturer, prior to flashing installation. Allow surface conditioner to dry completely before flashing application.
 - 2. Apply Primer by brush or heavy nap, natural-material roller at rate recommended by manufacturer prior to flashing installation. Allow primer to dry completely before flashing application.
 - 3. Provide stainless steel termination bar with a full bed of manufacturer's recommended sealant at the top of all flexible flashing. Refer to drawings for detail.
 - 4. Encapsulate stainless steel termination bar with the vapor permeable, fluid applied membrane air barrier per the manufacturer's strict instructions.
 - 5. Refer to drawings for details.
 - 6. Refer to manufacturers details for inside and outside wall flashing corners

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PROJECT WALL FLASHING WARRANTY

NAME OF PROJECT:	
PROJECT LOCATION:	
OWNER:	
GENERAL	CONTRACTOR
GENERAL	

SS&L Job No. 14057

ADDRESS:

DATE OF ACCEPTANCE:

DATE OF EXPIRATION:

- D. The Wall Flashing Contractor and the General Contractor do hereby certify that the wall flashing work included in this contract was installed in strict accordance with all requirements of the plans and specifications and in accordance with approved wall flashing manufacturers' recommendations.
- E. The Wall Flashing Contractor and the General Contractor do hereby guarantee the wall flashing and associated work including but not limited to all underground vertical and horizontal wall flashing to be water tight and free from all leaks, due to faulty or defective materials and workmanship for a period of five (5) years, starting on the date of substantial completion of the project.
- F. Subject to the terms and conditions listed below, the Wall Flashing Contractor and the General Contractor also guarantee that during the Guarantee Period he will, at his own cost and expense, make or cause to be made such repairs to, or replacements of said work, in accordance with the wall flashing manufacturers' recommendations as are necessary to correct faulty and defective work and/or materials which may develop in the work including. Anticipated life of the wall flashing systems and the best standards applicable to the particular wall flashing type in value and in accordance with construction documents as are necessary to maintain said work in watertight conditions, and further, to respond on or within seven (7) calendar days upon proper notification of leaks or defects by the Owner.
 - 1. During the Guarantee Period, if the Owner allows alteration of the work by anyone other the Wall Flashing Contractor or the General Contractor, including cutting, patching and maintenance in connection with penetrations, and positioning of

anything affected by, this Guarantee shall become null and void upon the date of said alterations

- 2. Future building additions will not void this Guarantee, except for that portion of the future addition that might affect the work under this contract at the point of connection of the wall flashed areas, and any damage caused by such addition. If this contract is for wall flashing of an addition to an existing building, then this guarantee covers the work involved at the point of connection with the existing.
- 3. The Owner shall promptly notify the Wall Flashing Contractor or the General Contractor of observed, known or suspected leaks, defects or deterioration, and shall afford reasonable opportunity for the Wall Flashing Contractor or the General Contractor to inspect the work, and to examine the evidence of such leaks, defects or deterioration.

IN WITNESS THEREOF, this instrument has been duly executed

This ______ day of ______.

Wall Flashing Contractor's General Contractor's Authorized Signature

or's Authorize

Authorized Signature

Typed Name and Title

Typed Name and Title

Notary Public

END OF SECTION 07650

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sealants and joint backing.
- B. Precompressed foam sealers.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 07 8401 Firestopping: Firestopping Sealants.
- C. Section 08 8000 Glazing: Glazing sealants and accessories.
- D. Section 09 2116 Gypsum Board Assemblies
- E. Section 09 3000 Tiling: Sealant used as tile grout.

1.03 REFERENCE STANDARDS

- A. ASTM C834 Standard Specification for Latex Sealants 2017.
- B. ASTM C919 Standard Practice for Use of Sealants in Acoustical Applications 2019.
- C. ASTM C1193 Standard Guide for Use of Joint Sealants 2016.
- D. SCAQMD 1168 Adhesive and Sealant Applications 1989 (Amended 2017).

1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Manufacturer's Installation Instructions: Indicate special procedures.

1.05 QUALITY ASSURANCE

- Maintain one copy of each referenced document covering installation requirements on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.06 MOCK-UP

A. Refer to 01 4000.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.08 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a the specified warranty periods.
 - 1. Unless noted otherwise, provide manufacturer's standard 5 year material warranty.
 - 2. Provide additional manufacturer's warranties listed for specific products.
- C. Provide General Contractor's Project Joint Sealant Warranty at the back of this specification section. Warranty to be signed by the Joint Sealant Contractor and General Contractor.
- D. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Silicone Sealants:
 - 1. Dow Corning: www.dowcorning.com
 - 2. Pecora Corporation: www.pecora.com.
 - 3. Tremco: www.tremcosealants.com
- B. Polyurethane Sealants:
 - 1. Pecora; www.pecora.com
 - 2. Sonneborn; www.chemrex.com
 - 3. Tremco; www.tremcosealants.com
- C. Acrylic Emulsion Latex Sealants:
 - 1. Pecora Corporation: www.pecora.com.
 - 2. Sonneborn; www.chemrex.com

3. Tremco; www.tremcosealants.com

2.02 SEALANTS

- A. Sealants and Primers General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
- B. Type I General Purpose Exterior Sealant: Silicone ; ASTM C 920, Grade NS, Class 25, Uses M ; single component, ultra low-mod.
 - 1. Color: To be selected by Architect from manufacturer's full range.
 - 2. Product:
 - a. Dow 790
 - b. Pecora 890
 - c. Tremco Spectrem-1
 - 3. Applications: Use for:
 - a. Vertical and horizontal construction joints between masonry/concrete/stone to masonry/concrete/stone.
 - 4. Warranties: In addition to manufacturer's standard product warranties, Provide manufacturer's 20 year Non-Staining and 20 year Structural Adhesion limited warranties. Provide manufacturer's compatibility testing as required.
- C. Type II General Purpose Exterior Sealant: Silicone ; ASTM C 920, Grade NS, Class 25, Uses M, G, and A; single component, structural
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Product;
 - a. Dow 795
 - b. Pecora 895
 - c. Tremco Spectrum -2
 - 3. Applications: Use for:
 - All other vertical and horizontal construction joints not listed in sealant type I & III.

- 4. Warranties: In addition to manufacturer's standard product warranties, Provide manufacturer's 20 year Non-Staining and 20 year Structural Adhesion limited warranties. Provide manufacturer's compatibility testing as required.
- D. Type III Exterior Expansion Joint Sealer: Precompressed foam sealer; urethane with water-repellent;
 - 1. Color: Black.
 - 2. Product: Equal to Backerseal by Emseal
 - 3. Size as required to provide weathertight seal when installed.
 - 4. Applications: Use for:
 - a. Exterior wall expansion joints used in conjunction with Dow 790
- E. Type IV General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type S, single component, paintable.
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Product:
 - a. Pecora AC-20
 - b. Tremco Tremflex 834
 - c. Sonneborn Sonolac
 - 3. Applications: Use for:
 - a. Interior wall and ceiling control joints.
 - b. Other interior joints for which no other type of sealant is indicated.
- F. Type V General Purpose Interior Sealant: Medium Modulas silicone sealant
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Products:
 - a. Dow 795
 - b. Percora 895
 - c. Tremco Spectrem-2
 - 3. Applications: Use for:

- a. Joints between aluminum door and window frames and adjacent wall surfaces.
- G. Type VI Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
 - 1. Product:
 - a. Dow 786
 - b. Tremco Tremsil 200
 - c. Pecora 898
 - 2. Applications: Use for:
 - a. Joints between plumbing fixtures and floor and wall surfaces.
 - b. Joints between kitchen and bath countertops and wall surfaces.
- H. Type VII Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C 920, Grade P, Class 25, Uses T, M and A; multi- component, type M
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Product:
 - a. Tremco THC 900/901
 - b. Pecora NR-200
 - c. Sonneborn- SL-2
 - 3. Applications: Use for:
 - a. Expansion joints in floors.
 - b. Joints between hard floor tile and hard floor tile and hard floor tile and adjacent wall surfaces for hard tile expansion joints.
- I. Type VIII Concrete Joint Sealant: Polyurethane; ASTM C 920, Class 25, Uses T, and M; multi- component (type M), Grade NS vertical and horizontal
 - 1. Color: Gray.
 - 2. Product:
 - a. Sonneborn NP-2
 - b. Pecora Dynatrol-II

- c. Tremco Dymeric 240 FC
- 3. Applications: Use for:
 - a. Joints in sidewalks and curb and gutters
 - b. Joints in concrete walls

2.03 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application, and compatible with joint substrates.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Sealant Backer Rod: Bi- Cellular Polyolefin foam rod equal to SOF ROD/ Nomaco and or Open cell Polyurethane foam equal to Foam Pak II/Nomaco. All backer rods shall be as recommended by sealant manufacture for specific use. Provide size and shape of rod to control joint depth, break bond at the bottom of joint, form optimum shape of bead on back side, and minimize the possibility of extrusion when joint is compressed.
- D. Joint Backing: Round foam rod compatible with sealant; oversized 25 percent larger than joint width.
- E. Tooling Agent: Agent recommended by material manufacturer to ensure contact of material with inner joint faces.
- F. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application. Provide self adhering tape where applicable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.
- H. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

Northport FMS #9	SS&L Job No. 14057	January 2022
Renovations		
Northport, AL		
PROJECT JOINT SEALA	ANT WARRANTY	
PROJECT :		
LOCATION		
LOCATION.		
OWNER :	······································	
WATERPROOFING		
CONTRACTOR		
ADDRESS		

DATE OF ACCEPTANCE _____ DATE OF EXPIRATION

The Joint Sealant Contractor and General Contractor do hereby certify that the above and underground work included in this contract was installed in strict accordance with all requirements of the plans and specifications and in accordance with approved joint sealants manufacturers' recommendations.

The Joint Sealant Contractor and General Contractor do hereby guarantee the joint sealants and associated work including but not limited to all above and underground vertical and horizontal joint sealants to be water tight and free from all leaks, due to faulty or defective materials and workmanship for a period of five (5) years, starting on the date of substantial completion of the project.

Subject to the terms and conditions listed below, the Joint Sealants Contractor and General Contractor also guarantee that during the guarantee period he will, at his own cost and expense, make or cause to be made such repairs to, or replacements of said work, in accordance with the joint sealant manufacturers recommendations as are necessary to correct faulty and defective work and/or materials which may develop in the work including. Anticipated life of the joint sealant systems and the best standards applicable to the particular joint sealant type in value and in accordance with construction documents as are necessary to maintain said work in watertight conditions, and further, to respond on or within seven (7) calendar days upon proper notification of leaks or defects by the Owner.

During the guarantee period, if the Owner allows alteration of the work by anyone other the Joint Sealant Contractor or General Contractor, including cutting, patching and maintenance in connection with penetrations, and positioning of anything affected by, this guarantee shall become null and void upon the date of said alterations.

Future building additions will not void this guarantee, except for that portion of the future addition that might affect the work under this contract at the point of connection Northport FMS #9 Renovations Northport, AL

of the joint sealant areas, and any damage caused by such addition. If this contract is for joint sealant of an addition to an existing building, then this guarantee covers the work involved at the point of connection with the existing.

The Owner shall promptly notify the Joint Sealant Contractor or General Contractor of observed, known or suspected leaks, defects or deterioration, and shall afford reasonable opportunity for the Joint Sealant Contractor or General Contractor to inspect the work, and to examine the evidence of such leaks, defects or deterioration.

IN WITNESS THEREOF,

THIS INSTRUMENT HAS BEEN DULY EXECUTED THIS _____ DAY OF _____(YEAR).

GENERAL CONTRACTOR'S JOINT SEALANT CONTRACTOR'S AUTHORIZED SIGNATURE AUTHORIZED SIGNATURE

TYPED NAME AND TITLE

TYPED NAME AND TITLE

Notary Public

END OF SECTION

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[1] A. Martin and M. Martin and M Martin and M. Martin an Martin and M. Martin and	an teach ann an an an an an ann an teach ann an tha ann an teach ann an ann ann ann an ann ann an teach ann an Ann ann an teachar ann an ann ann ann ann ann ann ann an
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PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated steel doors and frames.
- B. Steel frames for wood doors.
- C. Fire-rated steel doors and frames.
- D. Thermally insulated steel doors.
- E. Steel glazing frames.
- F. Contractor shall have the option on Selma FMS of refurbishing the existing hollow metal door frames as required to receive new hardware and new doors or preovide new hollow metal door frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 Door Hardware.
- B. Section 08 8000 Glazing: Glass for doors and borrowed lites.
- C. Section 09 9000 Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS

- A. ANSI/ICC A117.1 American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- B. ANSI/SDI A250.3 Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames 2019.
- C. ANSI/SDI A250.8 Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
- D. ANSI/SDI A250.10 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.
- E. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- F. ASTM C1363 Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2011.
- G. BHMA A156.115 Hardware Preparation In Steel Doors And Steel Frames 2016.

- H. NAAMM HMMA 840 Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2007.
- I. NAAMM HMMA 861 Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.
- J. NFPA 80 Standard for Fire Doors and Other Opening Protectives 2022.
- K. NFPA 252 Standard Methods of Fire Tests of Door Assemblies 2022.
- L. UBC Std 7-2, Part II Test Standard for Smoke- and Draft-control Assemblies; International Conference of Building Officials; 1997.
- M. UL 10B Standard for Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- N. UL 1784 Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years documented experience.
- B. Maintain at the project site a copy of all reference standards dealing with installation.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store in accordance with NAAMM HMMA 840.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Doors and Frames:
 - 1. Assa Abloy Ceco, Curries, or Fleming: www.assaabloydss.com/#sle.
 - 2. Republic Doors; Product [____]: www.republicdoor.com.
 - 3. Steelcraft: www.steelcraft.com.
 - 4. Substitutions: See Section 01 6000 Product Requirements.

2.02 DOORS AND FRAMES

- A. Requirements for All Doors and Frames:
 - 1. Accessibility: Comply with ANSI/ICC A117.1.
 - 2. Door Top Closures: Flush with top of faces and edges.
 - 3. Door Edge Profile: Beveled on both edges.
 - 4. Door Texture: Smooth faces.
 - 5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
 - 6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
 - 7. Galvanizing for Units in Wet Areas: All components hot-dipped zinc-iron alloycoated (galvannealed), manufacturer's standard coating thickness.
 - 8. Finish: Factory primed, for field finishing.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS, Type B.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A40 metallic coating.

2.04 STEEL DOORS

- A. Exterior Doors Type 1:
 - 1. Grade: ANSI A250.8 Level 2, physical performance Level B, Model 1, full flush.
 - 2. Core: Polystyrene foam.
 - 3. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
 - 4. Insulating Value: U-value of 0.50, when tested in accordance with ASTM C 1363
 - 5. Weatherstripping: Separate, see Section 08 7100.
- B. Interior Doors, Non-Fire-Rated:
 - 1. Grade: ANSI A250.8 Level 2, physical performance Level B, Model 1, full flush.
 - 2. Core: Vertical steel stiffeners.
- C. Panels: Same construction, performance, and finish as doors.
- D. Hardware Reinforcement: ANSI/SDI A250.6-1997.

2.05 STEEL FRAMES

- A. General:
 - 1. Comply with the requirements of grade specified for corresponding door.
 - a. ANSI A250.8 Level 1 Doors: 16 gage frames.
 - b. Frames for Wood Doors: Comply with frame requirements specified in NAAMM HMMA 860
 - 2. Finish: Same as for door.
 - 3. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high (100 mm high) to fill opening without cutting masonry units.
- B. Exterior Door Frames: Face welded, seamless with joints filled.

- 1. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
- 2. Weatherstripping: Separate, see Section 08 7100.
- C. Interior Door Frames, Non-Fire-Rated: Fully welded type.
 - 1. Terminated Stops: Provide at all interior doors; closed end stop terminated 6 inches (150 mm) above floor at 90 degree angle.
- D. Mullions for Pairs of Doors: Removable type, of profile similar to jambs.
- E. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match door frames, and as indicated on drawings.
- F. Hardware Reinforcement: ANSI/SDI A250.6.
- G. All frames are to wrap the entire wall. No butt conditions will be acceptable. Coordinate frame jamb depths with each wall condition.

2.06 ACCESSORY MATERIALS

- A. Louvers: Roll formed steel with overlapping frame; finish same as door components ; factory-installed. Equal to Titus CT700L refer to Mechanical.
 - 1. Style: Standard straight slat blade.
 - 2. Fasteners: Exposed or concealed fasteners.
- B. Glazing: As specified in Section 08 8000, factory installed.
- C. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.
- D. Stops and Moldings:
 - 1. Moldings for Glazed Lites in Doors & Windows: Minimum 0.032-inch (0.8 mm) thick, same material as door face sheet. Metal lite kits are to be flush and shall not require shim kits for door hardware.
 - 2. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.
 - 3. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, same material as frames.
- E. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.

- For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
 - a. Jamb Anchors:
 - Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
 - 2) Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
 - Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
 - b. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
 - 1) Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I.

2.07 FINISH MATERIALS

A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.

2.08 FABRICATION

A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

- B. Hollow Metal Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors. Seal joints in top edges of doors against water penetration with flush door cap.
 - 2. Glazed Lites: Factory cut openings in doors.
 - 3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.
- C. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - 6. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

- 1) Three anchors per jamb up to 60 inches (1524 mm) high.
- 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
- 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
- 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
- 5) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.
- c. Compression Type: Not less than two anchors in each jamb.
- d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
- 7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers.
 - a. Single-Door Frames: Three door silencers.
 - b. Double-Door Frames: Two door silencers.
- D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
 - 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 - 2. Reinforce doors and frames to receive nontemplated, mortised and surfacemounted door hardware.
 - 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 - 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 electrical Sections.
- E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.

- 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
- 4. Provide loose stops and moldings on inside of hollow metal work.
- 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

3.03 INSTALLATION

- A. Hollow Metal Frames and Stainless Steel Frames: Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

- h. Remove temporary "shipping spreader bars" before installation.
- 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
- 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
- 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
- 5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
- 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
- 7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
- 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
- 9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

- B. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors according to NFPA 105.
- C. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: As specified in ANSI A250.8.
- B. Maximum Diagonal Distortion: 1/16 in (1.5 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.
- B. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

PART I GENERAL

1.01 SECTION INCLUDES

A. Overhead coiling doors, operating hardware, non-fire-rated and exterior, manual and electric operation.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Section 08 7100 Door Hardware: Cylinder cores and keys.
- C. Section 09 9000 Painting.
- D. Section 26 0583 Wiring Connections: Power to disconnect.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M Standard Specification for Carbon Structural Steel 2019.
- B. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- C. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- D. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- E. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- F. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- G. NEMA ICS 2 Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).

1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide general construction and component connections and details.

- C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- D. Sample warranty
- E. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

1.05 QUALITY ASSURANCE

A. Warranty: Provide manufacturers warranty (24 month from substantial completion)

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Overhead Coiling Doors:
 - 1. Overhead Doors Company; Product Equal to: Overhead Door Model 625.
 - 2. Cornell Iron Works, Inc; [____]: www.cornelliron.com/#sle.
 - 3. The Cookson Company; [____]: www.cooksondoor.com/#sle.
 - 4. [____].

2.02 COILING DOORS

- A. Exterior Coiling Doors: Steel slat curtain.
 - 1. Capable of withstanding positive and negative wind loads of 20 psf (940 Pa), without undue deflection or damage to components.
 - 2. Sandwich slate construction with insulated core of foamed in place, CFC-free polyurethane insulation. Minimum R-value of 7.7 for door assembly.
 - 3. Nominal Slat Size: [5/8" thick x 3" wide] inches ([___] inches) wide x required length.
 - 4. Finish: Factory painted, PowderGuard Premium Powder Coat Finish, Manufacturer's Standard colors as selected by Architect and Owner's Representat, provide full range color selection.
 - 5. Guides: Angles; primed steel. job Painted, colors as selected by Architect and Owner's Representative
 - 6. Hood Enclosure: Manufacturer's standard; primed steel.
 - 7. Manual hand chain lift operation: at PEMB.

- 8. Electric Operation: at all FMS Overhead CoilinDoors.
- 9. Mounting: Within framed opening As indicated., 20,000 cycles
- 10. Weather Seals: Bottom exterior curtain-side guide, interior hood baffle

2.03 MATERIALS

- A. Curtain Construction: Interlocking slats.
 - 1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
 - 2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
 - 3. Weatherstripping: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
- B. Steel Slats: Minimum thickness, 24 gage ([____] mm); ASTM A653/A653M galvanized steel sheet. Insulated equal to Overhead door slat F-265i
- C. Steel Guides: ASTM A36/A36M steel angles, size as required for wind loading, prime painted.
- D. Hood Enclosure: Internally reinforced to maintain rigidity and shape. Provide 24 gauge galvanized steel. Mounted on Face of wall, interior side.
- E. Hardware:
 - 1. Latching: Inside mounted, adjustable keeper, spring activated latch bar with feature to keep in locked or retracted position.
- F. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb (10 kg) nominal force to operate.

2.04 ELECTRIC OPERATION

- A. Electric Operators:
 - 1. Mounting: Side mounted.
 - 2. Motor Enclosure:
 - 3. Motor Rating: 3/4 hp (560 W); continuous duty.

- 4. Motor Voltage: 120 volt, single phase, 60 Hz.
- 5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
- 6. Manual override in case of power failure.
- B. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of electrical service with Section 26 0583.
- F. Complete wiring from disconnect to unit components.

3.03 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch (1.5 mm).
- C. Maximum Variation From Level: 1/16 inch (1.5 mm).
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft (3 mm per 3 m) straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING
- A. Clean installed components.
- B. Remove labels and visible markings.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Infill panels of metal and glass.
- C. Aluminum doors and frames.
- D. Weatherstripping.
- E. Door hardware.
- F. Perimeter sealant.

1.02 RELATED REQUIREMENTS

- A. Section 05 1200 Structural Steel Framing: Steel attachment members.
- B. Section 07 2500 Weather Barriers: Sealing framing to weather barrier installed on adjacent construction.
- C. Section 07 9200 Joint Sealants: Sealing joints between frames and adjacent construction.
- D. Section 07 9005 Joint Sealers: Perimeter sealant and back-up materials.
- E. Section 08 7100 Door Hardware: Hardware items other than specified in this section.
- F. Section 08 8000 Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 Care and Handling of Architectural Aluminum from Shop to Site 2015.
- B. AAMA 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems 2015.
- C. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- D. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

- E. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- F. ASTM E283 Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).
- G. ASTM E330/E330M Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).
- H. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details and [____].
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
- D. Samples: Submit two samples 12 x 12 inches (____x mm) in size illustrating finished aluminum surface, glass, infill panels, glazing materials.
- E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer and Installer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after the Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

- A. Center-Set Style, Thermally-Broken:
 - 1. Basis of Design: Kawneer VersaGlaze 451T.
 - Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep (50 mm wide by 114 mm deep).
- B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
 - 1. Coral Architectural Products, a division of Coral Industries, Inc: www.coralap.com/#sle.
 - 2. C.R. Laurence Co., Inc; U.S. Aluminum: www.crl-arch.com/#sle.

- 3. EFCO, a Pella Company: www.efcocorp.com/#sle.
- 4. Trulite Glass and Aluminum Solutions, LLC: www.trulite.com.
- C. Substitution Procedures: See Section 01 6000 Product Requirements.

2.02 BASIS OF DESIGN -- SWINGING DOORS

- A. Medium Stile, Non- Insulating Glazing, Not Thermally-Broken (Interior):
 - 1. Basis of Design: Kawneer 350 Standard Entrance of Approved Equal.
 - 2. Thickness: 1-3/4 inches (43 mm).
 - 3. Sightline 3-1/2 inches
 - 4. Bottom rail: 10 inches unless noted otherwise.

2.03 APPLICATION SCHEDULE

- A. Provide thermally broken systems at all exterior applications.
- B. Provide non-thermally broken systems at all interior applications.

2.04 STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Glazing Position: Centered (front to back).
 - 2. Finish: Class II natural anodized.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
 - 3. Finish Color: As selected by Architect from manufacturer's standard line.
 - 4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - 5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - 6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and

migrating moisture occurring within system.

- 7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
- 8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
- 9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- B. Performance Requirements:
 - Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
 - 2. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
 - 3. Air Leakage: Maximum of 0.06 cu ft/min sq ft (0.3 L/sec sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 psf (300 Pa) pressure differential across assembly.

2.05 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 - 1. Glazing Stops: Flush.
- B. Glazing: As specified in Section 08 8000.
- C. Swing Doors: Glazed aluminum.

2.06 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.

- C. Perimeter Sealant: Type [____] specified in Section 07 9005.
- D. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.07 FINISHES

- A. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.
- B. Color: As indicated on drawings.

2.08 HARDWARE

- A. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
- B. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.
- C. Exit Devices: Panic type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

- H. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- J. Set thresholds in bed of sealant and secure.
- K. Install hardware using templates provided.
- L. Install glass and infill panels in accordance with Section 08 8000, using glazing method required to achieve performance criteria.
- M. Install perimeter sealant in accordance with Section 07 9005.
- N. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 1/16 inches per 10 ft (1.5 mm/3 m), whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.

3.05 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- C. Remove excess sealant by method acceptable to sealant manufacturer.

3.07 PROTECTION

A. Protect installed products from damage during subsequent construction.

END OF SECTION

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SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 06 Section "Rough Carpentry".
 - 2. Division 06 Section "Finish Carpentry".
 - 3. Division 08 Section "Operations and Maintenance".
 - 4. Division 08 Section "Door Schedule".
 - 5. Division 08 Section "Hollow Metal Doors and Frames".
 - 6. Division 08 Section "Flush Wood Doors".
 - 7. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC International Building Code.
 - 3. NFPA 70 National Electrical Code.
 - 4. NFPA 80 Fire Doors and Windows.
 - 5. NFPA 101 Life Safety Code.
 - 6. NFPA 105 Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.

DOOR HARDWARE

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Northport FMS#9 Renovations Northport, AL

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

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E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s),

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Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

- 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
- 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
- 3. Review sequence of operation narratives for each unique access controlled opening.
- 4. Review and finalize construction schedule and verify availability of materials.
- 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions

of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Seven years for heavy duty cylindrical (bored) locks and latches.
 - 2. Five years for exit hardware.
 - 3. Twenty five years for manual overhead door closer bodies.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 - 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
 - 5. Manufacturers:
 - a. Hager Companies (HA).
 - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
 - c. Stanley Hardware (ST).

2.3 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
 - 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 - 2. Furnish dust proof strikes for bottom bolts.
 - 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 - 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

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- Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 - 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 - 5. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 - 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 - 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 - Tubular deadlocks and other auxiliary locks.
 - 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
- C. Interchangeable Cores: Provide small format interchangeable cores as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.

- 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
- 3. Existing System: Field verify and key cylinders to match Owner's existing system.
- E. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Two (2)
 - 2. Master Keys (per Master Kcy Level/Group): Five (5).
 - 3. Construction Keys (where required): Ten (10).
- F. Construction Keying: Provide construction master keyed cylinders.
- G. Key Registration List (Bitting List):
 - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 - 2. Provide transcript list in writing or electronic file as directed by the Owner.
- H. The General Contractor shall review all existing to remain hardware and replace all existing to remain interchangeable cores with new cores. Coordinate with Owner for keying.

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.
 - 1. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
 - 2. Locks are to be non-handed and fully field reversible.
 - 3. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.2 requirements to 2 million cycles.
 - 4. Manufacturers:
 - a. Corbin Russwin Hardware (RU) CL3300 Series.
 - b. dormakaba Best (BE) 9K Series.
 - c. Sargent Manufacturing (SA) 10 Line.

2.6 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

- 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
- 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
- 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
 - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 - 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 - 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 - 4. Dustproof Strikes: BHMA A156.16.

2.7 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 - 1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 - 2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 - 3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 - 4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 - 5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 - 6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

- 7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
- 8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
- 9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
- 10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
 - 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) ED4000 / ED5000 Series.
 - b. Sargent Manufacturing (SA) 80 Series.
 - c. Von Duprin (VD) 35A/98 XP Series.

2.8 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
 - 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 - 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 - 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 - 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 - 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 - 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to

DOOR HARDWARE

door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

- 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) DC8000 Series.
 - b. Norton Door Controls (NO) 9500 Series.
 - c. Sargent Manufacturing (SA) 281 Series.

2.9 ARCHITECTURAL TRIM

- A. Door Protective Trim
 - 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
 - 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
 - 3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
 - 4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
 - 5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
 - 6. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.10 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated,

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unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

- 1. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 - 1. Manufacturers:
 - a. Rixson Door Controls (RF).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Sargent Manufacturing (SA).

2.11 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket scals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authoritics having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

- F. Manufacturers:
 - 1. National Guard Products (NG).
 - 2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
 - 3. Reese Enterprises, Inc. (RE).

2.12 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.13 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

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3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures" and "Cash Allowances". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to

operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Quantities listed are for each pair of doors, or for each single door.
 - 2. The supplier is responsible for handing and sizing all products.
 - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
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 - 4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.
- B. Manufacturer's Abbreviations:
 - 1. MK McKinney 2. RO - Rockwood
 - 3. SA SARGENT

DOOR HARDWARE

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4. RF - Rixson 5. PE - Pemko

Hardware Sets

Set: 1.0

Doors: 123 Description: EXT PR - PARTS

6	Hinge (heavy weight)	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
2	Surface Bolt	580-8	US32D	RO
1	Storeroom Lock	70 10G04 LL	US26D	SA
2	Small Format Inter Core	Best KW - Match existing	US15	SA
2	Surface Closer	281 CPSH	EN	SA
2	Armor Plate	K1050 36" X 2" LDW 4BE CSK	US32D	RO
1	Threshold	271A MSES25SS		PE
1	Gasketing	S88D		PE
1	Rain Guard	346C x LAR		PE
2	Sweep	315CN		PE
1	Astragal	357SP X S88D		PE

Set: 2.0

Doors: 118, 119, 120, 121 Description: BAY PR

8	Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
2	Flush Bolt	555 [12" / 72" AFF]	US26D	RO
1	Storeroom Lock	70 10G04 LL	US26D	SA
1	Small Format Inter Core	Best KW - Match existing	US15	SA
2	Door Closer	281 PS	EN	SA
2	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Threshold	271A MSES25SS		PE
1	Gasketing	S88D		PE
2	Sweep	315CN		PE
1	Astragal	357SP X S88D		PE

Set: 3.0

Doors: 131 Description: EXT- CORR - EAC

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3	Hinge (heavy weight)	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
1	Exit Device (storeroom)	70 8804 Less Pull	US32D	SA
1	Small Format Inter Core	Best KW - Match existing	US15	SA
1	Surface Closer	281 CPS	EN	SA
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Threshold	271A MSES25SS		PE
1	Gasketing	\$88D		PE
1	Rain Guard	346C x LAR		PE
1	Sweep	315CN		PE

Notes:

Set: 4.0

Doors: 122 Description: EXT - (EO)

3	Hinge (heavy weight)	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
1	Rim Exit Device, Exit Only	8810 EO	US32D	SA
1	Surface Closer	281 CPS	EN	SA
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Threshold	271A MSES25SS		PE
1	Gasketing	S88D		PE
1	Rain Guard	346C x LAR		PE
1	Sweep	315CN		PE

Set: 5.0

Doors: 101B Description: EXT-STOR

3	Hinge (heavy weight)	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
1	Storeroom Lock	70 10G04 LL	US26D	SA
1	Small Format Inter Core	Best KW - Match existing	US15	SA
1	Surface Closer	281 CPSH	EN	SA
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Threshold	271A MSES25SS		PE
1	Gasketing	S88D		PE
1	Rain Guard	346C x LAR		PE

DOOR HARDWARE

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Northport FMS#9 SS&L Job No.: 14057 January 2022 Renovations Northport, AL 1 Sweep 315CN PE Set: 6.0 Doors: 125 Description: RECEIVING MK 3 Hinge, Full Mortise TA2714 4-1/2" x 4-1/2" US26D 1 Office Lock 70 10G05 LL US26D SA 1 Small Format Inter Core Best KW - Match existing **US15** SA 1 Door Closer 281 Reg / PA EN SA 1 Kick Plate K1050 10" X 2" LDW 4BE CSK US32D RO 1 Wall Stop 409 / 446 [as required] US32D RO 1 Gasketing S88D PE Set: 7.0 Doors: 126, 127, 128 Description: TOOL RM 3 Hinge, Full Mortise TA2714 4-1/2" x 4-1/2" US26D MK 1 Storeroom Lock 70 10G04 LL US26D SA 1 Small Format Inter Core Best KW - Match existing **US15** SA 1 Door Closer 281 PS EN SA 1 Kick Plate K1050 10" X 2" LDW 4BE CSK US32D RO 3 Silencer 608 RO Notes: Set: 8.0 Doors: 129 Description: BATTERY PR 6 Hinge, Full Mortise TA2714 4-1/2" x 4-1/2" US26D MK 2 Flush Bolt 555 [12" / 72" AFF] US26D RO 1 Dust Proof Strike 570 US26D RO SA

1 Storeroom Lock70 10G04 LLUS26D1 Small Format Inter CoreBest KW - Match existingUS152 Surface Closer281 PSHEN2 Kick PlateK1050 10" X 2" LDW 4BE CSKUS32D

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Northport FMS#9 Renovations Northport, AL	SS&L Job No.: 14057	January 2022
2 Silencer	608	RO
Notes: Presenting a valid cre REX (request to exit) switch Entry by key override at all t	dential retracts the latchbolt to allow free entry, in device rail allow for free exit at all times imes	, door relocks upon closing.

Door is fail secure

Set: 9.0

Doors: 114 Description: BREAK

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Passage Set	10U15 LL	US26D	SA
1	Door Closer	281 PS	EN	SA
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Threshold	271A MSES25SS		PE
1	Gasketing	S88D		PE
1	Sweep	315CN		PE

Notes: Coordinate hardware requirements with existing door / frame. Verify lock functions and hardware compatibility prior to ordering any hardware

Set: 10.0

Doors: 115 Description: LOCKER

Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
Push Plate	70E	US32D	RO
Door Pull	BF168	US32D	RO
Door Closer	281 Reg / PA	EN	SA
Mop Plate	K1050 4" X 1" LDW 4BE CSK	US32D	RO
Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
Wall Stop	409 / 446 [as required]	US32D	RO
Threshold	271A MSES25SS		PE
Gasketing	S88D		PE
Sweep	315CN		PE
	Hinge (heavy weight) Push Plate Door Pull Door Closer Mop Plate Kick Plate Wall Stop Threshold Gasketing Sweep	Hinge (heavy weight)T4A3786 4-1/2" x 4-1/2"Push Plate70EDoor PullBF168Door Closer281 Reg / PAMop PlateK1050 4" X 1" LDW 4BE CSKKick PlateK1050 10" X 2" LDW 4BE CSKWall Stop409 / 446 [as required]Threshold271A MSES25SSGasketingS88DSweep315CN	Hinge (heavy weight) T4A3786 4-1/2" x 4-1/2" US26D Push Plate 70E US32D Door Pull BF168 US32D Door Closer 281 Reg / PA EN Mop Plate K1050 4" X 1" LDW 4BE CSK US32D Kick Plate K1050 10" X 2" LDW 4BE CSK US32D Wall Stop 409 / 446 [as required] US32D Fhreshold 271A MSES25SS S88D Sweep 315CN Stop

Notes: Coordinate hardware requirements with existing frame. Confirm hardware preps work with

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specified hardware prior to ordering doors / hardware.

Set: 11.0

Doors: 117 Description: STOR PR

6	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
2	Flush Bolt	555 [12" / 72" AFF]	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Storeroom Lock	70 10G04 LL	US26D	SA
1	Small Format Inter Core	Best KW - Match existing	US15	SA
2	Surf Overhead Stop / Holder	10-X36	689	RF
1	Gasketing	S88D		PE
2	Sweep	315CN		PE
1	Astragal	357SP X S88D		PE

Set: 12.0

Doors: 103B, 130 Description: STOR

3	Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	70 10G04 LL	US26D	SA
1	Small Format Inter Core	Best KW - Match existing	US15	SA
1	Door Closer	281 Reg / PA	EN	SA
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Wall Stop	409 / 446 [as required]	US32D	RO
3	Silencer	608		RO

Set: 13.0

Doors: 124 Description: OFFICE

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Office Lock	70 10G05 LL	US26D	SA
1 Small Format Inter Core	Best KW - Match existing	US15	SA
1 Wall Stop	409 / 446 [as required]	US32D	RO
3 Silencer	608		RO

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Set: 14.0

Doors: 113 Description: BREAK

3	Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Push Plate	70E	US32D	RO
1	Door Pull	BF168	US32D	RO
1	Surface Closer	281 CPS	EN	SA
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Threshold	271A MSES25SS		PE
1	Gasketing	S88D		PE
1	Sweep	315CN		PE

Notes: Coordinate hardware requirements with existing frame. Confirm hardware preps work with specified hardware prior to ordering doors / hardware.

Set: 15.0

Doors: 116 Description: TOILET

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Set	10U65 LL	US26D	SA
1 Door Closer	281 Reg / PA	EN	SA
1 Mop Plate	K1050 4" X 1" LDW 4BE CSK	US32D	RO
1 Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	409 / 446 [as required]	US32D	RO
1 Gasketing	S88D		PE
1 Sweep	315CN		PE

Set: 16.0

Doors: 101, 102, 102B, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112 Description: OH DOOR

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END OF SECTION 08 7100

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DOOR HARDWARE

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PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass.
- B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 Joint Sealers: Sealant and back-up material.
- B. Section 08 4313 Aluminum-Framed Storefronts: Glazing furnished by storefront manufacturer.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 Safety Standard for Architectural Glazing Materials Current Edition.
- B. ANSI Z97.1 American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.
- C. ASTM C864 Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).
- D. ASTM C920 Standard Specification for Elastomeric Joint Sealants 2018.
- E. ASTM C1036 Standard Specification for Flat Glass 2021.
- F. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- G. ASTM C1193 Standard Guide for Use of Joint Sealants 2016.
- H. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- I. ASTM E1300 Standard Practice for Determining Load Resistance of Glass in Buildings 2016.
- J. ASTM E2190 Standard Specification for Insulating Glass Unit Performance and Evaluation 2010.
- K. GANA (GM) GANA Glazing Manual 2008.
- L. GANA (SM) GANA Sealant Manual 2008.

M. GANA (LGRM) - Laminated Glazing Reference Manual 2009.

1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- D. Samples: Submit two samples 12 x 12 inch in size of glass and plastic units, showing coloration and design.
- E. Manufacturer's Certificate: Certify that sealed insulated glass meets or exceeds specified requirements.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA Glazing Manual and FGMA Sealant Manual for glazing installation methods.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F (10 degrees C).

1.07 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

PART 2 PRODUCTS

2.01 INSULATING GLASS UNITS

- A. For new storefront, provide tempered glass in locations required by all governing codes.
- B. Type G-1: 1/4" Single Vision Glazing.
 - 1. Application: All interior glazing unless otherwise indicaqted.
 - 2. Type: Fully tempered float glass.
 - 3. Tint: Clear.
 - 4. Thickness 1/4" inch (6mm).
 - 5. Polish all exposed edges.
- C. Type IG-1 Sealed Insulating Glass Units: 1" thick Vision glazing with 1/2" airfill cavity.
 - 1. Application: All exterior glazing unless otherwise indicated.
 - 2. Space between lites filled with air.
 - 3. Outboard Lite: Fully tempered float glass, 1/4 inch (6 mm) thick, minimum.
 - a. Tint: PPG Solar Gray on #2 surface or equal..
 - 4. Inboard Lite: Fully tempered float glass, 1/4 inch (6 mm) thick, minimum.
 - a. Tint: Clear.
 - b. Coating: PPG Solarban 70 XL Low E or equal, on #3 surface.
 - 5. Total Thickness: 1 inch (25 mm).
 - 6. Transmittance: Ultraviloet 8%; visible 35%; total solar energy 18%
 Reflectance Visible light 7%; total solar energy 14%
 U-Value: Winter night-time 0.28; Summer day-time 0.26
 Shading Coefficiant: 0.27
 Solar Heat Gain Coefficient: 0.24
 Light to Solar Gain: 1.33
 - 7. Glazing Method: Gasket glazing.

2.02 EXTERIOR GLAZING ASSEMBLIES

- A. Performance Criteria: Select type and thickness of glass to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - 2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 - 3. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
 - 4. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier:
 - 1. In conjunction with vapor retarder and joint sealer materials described in other sections.
- C. Thermal and Optical Performance: Provide glass products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 5.2/6.3 computer program.
 - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 5.2/6.3
 - 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

- A. Float Glass Manufacturers:
 - 1. AGC Flat Glass North America, Inc: www.na.agc-flatglass.com.
 - 2. Guardian Industries Corp: www.sunguardglass.com.
 - 3. Pilkington North America Inc: www.pilkington.com/na.
 - 4. PPG Industries, Inc: www.ppgideascapes.com.
 - 5. Substitutions: Refer to Section 01 6000 Product Requirements.
- B. Float Glass: Provide float glass based glazing unless noted otherwise.
- 1. Annealed Type: ASTM C1036, Type I Transparent Flat, Class 1 Clear, Quality-Q3.
- 2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and Kind FT.
- 3. Tinted Types: ASTM C1036, Class 2 Tinted, color and performance characteristics as indicated.
- 4. Thicknesses: As indicated; for exterior glazing comply with requirements indicated for wind load design regardless of thickness indicated.

2.04 SEALED INSULATING GLASS UNITS

- A. Sealed Insulating Glass Units: Types as indicated.
 - 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 - 2. Edge Spacers: Aluminum, bent and soldered corners.
 - 3. Edge Seal: Glass to elastomer.
 - 4. Purge interpane space with dry hermetic air.

2.05 GLAZING COMPOUNDS

- A. Manufacturers:
 - 1. Bostik Inc: www.bostik-us.com.
 - 2. Pecora Corporation: www.pecora.com.
 - 3. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - 4. Substitutions: Refer to Section 01 6000 Product Requirements.
- B. Butyl Sealant, Type [__]: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

2.06 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option

 Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or
 minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x
 height to suit glazing method and pane weight and area.

- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option I. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
 - 1. Manufacturers:
 - a. Pecora Corporation: www.pecora.com.
 - b. Tremco Global Sealants: www.tremcosealants.com.
 - c. Substitutions: Refer to Section 01 6000 Product Requirements.
- D. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; hardness range of 5 to 30 cured Shore A durometer; coiled on release paper; black color.
 - 1. Width: As required for application.
 - 2. Thickness: As required for application.
 - 3. Spacer Rod Diameter: As required for application.
 - 4. Manufacturers:
 - a. Pecora Corporation: www.pecora.com.
 - b. Tremco Global Sealants: www.tremcosealants.com.
 - c. Substitutions: Refer to Section 01 6000 Product Requirements.
 - d.
- E. Glazing Splines: Resilient polyvinyl chloride extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; [____] color.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings for glazing are correctly sized and within tolerance, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to

receive glazing.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proprer sealant adhesion.
- D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.
- E. Install sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing refrenced standards.
- B. Install glazing selaants in accordance with ASTM C1193, GANA Sealant Manual, and manufcaturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

- A. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.
- B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - EXTERIOR DRY METHOD (TAPE AND GASKET SPLINE GLAZING)

- A. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- E. Trim protruding tape edge.

3.06 FIELD QUALITY CONTROL

- A. Glass product manufacturers to provide field surveillance of the installation of their products.
- B. Monitor and report installation procedures and unacceptable conditions.

3.07 CLEANING

- A. Remove glazing materials from finish surfaces immediately lafter application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immedately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fuly cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to the Date of Final Completion in accordance with glass manufcaturer's written recommendations.

3.08 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damanged during construction period prior to the Date of Final Completion.

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic unfaced batt insulation.
- E. Gypsum wallboard.
- F. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 06 1000 Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 07 9200 Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

- A. ASTM C475/C475M Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017.
- B. ASTM C645 Standard Specification for Nonstructural Steel Framing Members 2018.
- C. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- D. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.
- E. ASTM C840 Standard Specification for Application and Finishing of Gypsum Board 2020.
- F. ASTM C954 Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness 2018.

- G. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2020.
- H. ASTM C1396/C1396M Standard Specification for Gypsum Board 2017.
- I. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.
- J. GA-216 Application and Finishing of Gypsum Panel Products 2016, with Errata.
- K. ICC (IBC) International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- D. Test Reports: For all stud framing products that do not comply with ASTM C645 or C 754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board application and finishing with minimum five (5) years of documented experience.
- B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.02 METAL FRAMING MATERIALS (for interior partitions, refer to drawings for width & height)

- A. Manufacturers Metal Framing, Connectors, and Accessories:
 - 1. Clarkwestern Dietrich Building Systems LLC; Product [____]: www.clarkdietrich.com/#sle.

- 2. Dietrich Metal Framing: www.dietrichindustries.com.
- 3. Marino: www.marinoware.com/#sle.
- 4. Phillips Manufacturing Company: www.phillipsmfg.com.
- 5. Substitutions: See Section 01 6000 Product Requirements.
- B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa).
 - 1. Studs: "C" shaped with flat or formed webs with knurled faces.
 - 2. Runners: U shaped, sized to match studs.
 - 3. Ceiling Channels: C shaped.
 - 4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
 - 5. Resilient Furring Channels: 1/2 inch (12 mm) depth, for attachment to substrate through one leg only.
 - a. Manufacturers Resilient Furring Channels:
 - 1) Same manufacturer as other framing materials.
- C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

2.03 BOARD MATERIALS

- A. Manufacturers Gypsum-Based Board:
 - 1. American Gypsum: www.americangypsum.com.
 - 2. CertainTeed Corporation: www.certainteed.com/#sle.
 - 3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
 - 4. Lafarge North America Inc: www.lafargenorthamerica.com.
 - 5. National Gypsum Company: www.nationalgypsum.com/#sle.
 - 6. USG Corporation: www.usg.com/#sle.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.

- 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
- 3. Thickness:
 - a. Vertical Surfaces: 5/8 inch (16 mm).
 - b. Ceilings: 5/8 inch (16 mm).
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
- 4. Mold-Resistant Paper-Faced Products:
 - a. American Gypsum Company; M-Bloc Type X.
 - b. Continental Building Products; Mold Defense Type X.
 - c. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard.
 - d. National Gypsum Company; Gold Bond Brand XP Gypsum Board. (Basis of Design)

2.04 ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: [_] inch (_____mm).
- B. Acoustic Insulation: {\rs\#1}; preformed glass fiber, friction fit type, unfaced. provide at all interior gypsum board/metal stud partitons to the full width of the partition and to the full height of the partition
- C. Refer to Section 07 2000
- D. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
 - 1. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
 - 2. Ready-mixed vinyl-based joint compound.
- E. Screws for Attachment to Steel Members Less Than 0.03 inch (0.7 mm) In Thickness, to Wood Members, and to Gypsum Board: ASTM C1002; self-piercing tapping type; cadmium-plated for exterior locations.
- F. Screws for Attachment to Steel Members From 0.033 to 0.112 inch (0.8 to 2.8 mm) in Thickness: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.

- G. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- H. Unfaced Sound Batt Insulation: Provide in all interior (non-building perimeter) walls for full height of wall in full thickness of cavity.
 - 1. ASTM E136, CAN4-114
 - 2. ASTM C665, TYPE I
 - 3. MEA 346-90, ASTEM E-84

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members at 16 inches on center (at 400 mm on center).
 - 1. Laterally brace entire suspension system.
- C. Studs: Space studs at [_] inches on center (at 400 mm on center).
 - 1. Extend partition framing to structure in all locations.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
- F. Acoustic Furring: Install resilient channels at maximum 24 inches (600 mm) on center. Locate joints over framing members.
- G. Blocking: Install wood blocking for support of:
 - 1. Wall mounted cabinets.
 - 2. Toilet partitions.

- 3. Toilet accessories.
- 4. In all locations noted elsewhere
- 5. As required for the secure installation of any product to be attached to metal /stud gypsum partitions or ceilings

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Provide sound batt insulation in the same thickness as the metal stud wall cavity in all new partitions from floor to top of partition. Unfaced Sound Batts ASTM C665,type 1,and MEA 346-90 requirements ,ASTM E 84, friction fit in metal studs.
- C. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. Place one bead continuously on substrate before installation of perimeter framing members.
 - 2. In non-fire-rated construction, seal around all penetrations by conduit, pipe, ducts, and rough-in boxes.

3.04 BOARD INSTALLATION

- A. Comply with ASTM C 840, GA-216, ASTM C 840, GA-216, ASTM C 840, and GA-216. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Installation on Metal Framing: Use screws for attachment of all gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Install Batt Insulation per manufacturers recommendations.
- D. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinylbased joint compound and finished with ready-mixed vinyl-based joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 2. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

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PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 26 5100 Interior Lighting: Light fixtures in ceiling system.

1.03 REFERENCE STANDARDS

- A. ASTM C635/C635M Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.
- B. ASTM C636/C636M Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.
- C. ASTM E1264 Standard Classification for Acoustical Ceiling Products 2019.
- D. NFPA 286 Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth 2019.
- E. UL (FRD) Fire Resistance Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on suspension system components.
- C. Samples: Submit two samples _12_by12__ inch (___by___ mm) in size illustrating material and finish of acoustical units.

- D. Samples: Submit two samples each, [___] inches ([___] mm) long, of suspension system main runner.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

- A. Fire-Resistive Assemblies: Complete assembly listed and classified by {\rs\#1} for the fire resistance indicated.
- B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Panels: Type 1
 - Armstrong World Industries, Inc; [___]: www.armstrong.com.(Basis of Design-Armstrong Fine Fissured 1728, USG Radar 2210, 2x2 x 5/8 inch with 15/16" Square Layin), sag resistance Humid guard Plus, Class A, ASTM 84, ASTM E1264, Meets CA dept. of health VOC Emissions, Anti Mold & Bacteria Bio-Block, 1.5 R Value. (BTU units), 30 year manufacturers warranty
 - a. 2x4x5/8" panels to be placed into existing grid, refer to drawings.
 - 2. CertainTeed Corporation; [____]: www.certainteed.com/#sle.
 - 3. USG; [____]: www.usg.com/#sle.
 - 4. [____].

- 5. Substitutions: See Section 01 6000 Product Requirements.
- B. Suspension Systems:
 - Armstrong World Industries, Inc; [___]: www.armstrong.com. (basis of design Prelude XL 7300 15/16" white) approved equals must meet basis of design: Donn DX, Chicago Metallic 1200,USG DX Heavy duty 15/16, 10 year warranty, 10 year warranty with Humid guard plus products, Superlock, hot dipped Galvanized coating, secure lock connection.
 - 2. CertainTeed Corporation; [____]: www.certainteed.com/#sle.
 - 3. USG; [____]: www.usg.com/#sle.
 - 4. Substitutions: See Section 01 6000 Product Requirements.

2.02 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12-gage 0.08 inch (2 mm) galvanized steel wire.
- C. Touch-up Paint: Type and color to match acoustical and grid units.
- D. Clean and touch up existing grid to remain.

PART 3 EXECUTION

3.01 INSTALLATION - SUSPENSION SYSTEM

- A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- B. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- C. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

- F. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.
- G. Do not eccentrically load system or induce rotation of runners.

3.02 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.
- G. omitted.

3.03 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient base.
- B. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

- A. ASTM E648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
- B. ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2021.
- C. ASTM F1861 Standard Specification for Resilient Wall Base 2021.
- D. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Concrete Testing Standard: Submit a copy of ASTM F710.
- E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

- 1. See Section 01 6000 Product Requirements, for additional provisions.
- 2. Extra Wall Base: 50 linear feet ([____] linear meters) of each type and color.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect roll materials from damage by storing on end.

1.06 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

1.07 WARRANTY

A. Provide manufacturer's 20 year limited warranty.

PART 2 PRODUCTS

2.01 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove, and as follows:
 - 1. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.
 - 2. Height: 4 inch (100 mm).
 - 3. Thickness: 0.125 inch (3.2 mm) thick.
 - 4. Finish: Satin.
 - 5. Length: Roll.
 - 6. Accessories: Premolded external corners and end stops.

2.02 ACCESSORIES

- A. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer to suit floor tile and substrate conditions on site.
 - 1. Comply with VOC restrictions specified in 01 6116
- B. Moldings, Transition and Edge Strips: as indicated on the drawings...

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

3.02 PREPARATION

- A. Clean substrate.
- B. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of substrate conditions.
- B. Install in accordance with manufacturer's instructions.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Fit joints tightly.

3.04 RESILIENT BASE

- A. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces.
- C. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- D. Scribe and fit to door frames and other interruptions.
- E. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- F. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned. Fit joints tightly and make vertical.
- G. Install premolded corners before installing straight pieces.
- H. Job-Formed Corners:
 - Inside Corners: Use straight pieces of maximum lengths possible. Form by 1. cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.05 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's instructions.

3.06 EXTRA MATERIALS

A. At Closeout, provide the owner with a minimum of 50 feet of each color of rubber base.

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factoryfinished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - Items fully factory-finished unless specifically so indicated; materials and products 1. having factory-applied primers are not considered factory finished.
 - 2. Pre-engineered prefinished metal building components. Including primed structural members, unless noted on finish schedule in a room as paint walls.
 - 3. Items indicated to receive other finishes.
 - Items indicated to remain unfinished. 4.
 - 5. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 6. Non-metallic roofing and flashing.
 - 7. Stainless steel, anodized aluminum, bronze, terne, and lead items.
 - 8. Floors, unless specifically so indicated. (refer to finish schedule)
 - 9 Toilet Accessories and Toilet Partitions+
 - 10. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 05 5000 Metal Fabrications: Shop-primed items.
- C. Section 09 2116 Gypsum Board Assemblies

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
- B. ASTM D16 Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.
- C. ASTM D4442 Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- D. GreenSeal GS-11 Paints, Coatings, Stains, and Sealers 2015.

1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Product Data: Provide data on all finishing products, including VOC content.
- D. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.
- E. Certification: By manufacturer that all paints and coatings do not contain any of the prohibited chemicals specified; GreenSeal GS-11 certification is not required but if provided shall constitute acceptable certification.
- F. Samples: Provide samples of all colors and types of coatings, proceed only after receiving owner written approval and architect written approval.
- G. Manufacturer's Instructions: Indicate special surface preparation procedures.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 Product Requirements, for additional provisions.
 - 2. Extra Paint and Coatings: 1 gallon (4 L) of each color; store where directed.

3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.07 MOCK-UP

- A. See Section 01 4000 Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 10 feet (10 m) long by [10] feet ([___] m) wide, illustrating special coating color, texture, and finish.
- C. Provide door and frame assembly illustrating paint coating color, texture, and finish.
- D. Locate where directed.
- E. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.
- C. Paints:
 - 1. Base Manufacturer: Sherwin-Williams.
 - 2. Behr Process Corporation: www.behr.com/#sle.
 - 3. Glidden Professional, a product of PPG Architectural Coatings: www.gliddenprofessional.com.
 - 4. Benjamin Moore & Co: www.benjaminmoore.com/#sle.
 - 5. PPG Architectural Finishes, Inc: www.ppgaf.com/#sle.
 - 6. Pratt & Lambert Paints: www.prattandlambert.com/#sle.
- D. Transparent Finishes:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- E. Primer Sealers: Same manufacturer as top coats.
- F. Block Fillers: Same manufacturer as top coats.
- G. Substitutions: See Section 01 6000 Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

- A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
 - 1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each coating material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
- B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

- 1. Gypsum Board: Interior Latex Primer Sealer; MPI #50.
- 2. Wood: Latex Primer for Interior Wood; MPI #39.
- 3. Steel, Uncoated: Anti-Corrosive Alkyd Primer for Metal; MPI #79.
- 4. Steel, Uncoated: Interior Rust-Inhibitive Water Based Primer; MPI #107.
- Steel -- Shop Primer: Interior/Exterior Quick Dry Alkyd Primer for Metal; MPI #76.
- C. Volatile Organic Compound (VOC) Content:
 - 1. Provide coatings that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- D. Colors: To be selected from manufacturer's full range of available colors.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Paint E-OP All Exterior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including concrete.
 - 1. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
 - 2. Primer(s): As recommended by manufacturer of top coats.
- B. Paint CE-OP-3L Masonry/Concrete, Opaque, Waterproofing Coating:
 - 1. Primer: B25W00025 PrepRite Block Filler White..
 - 2. **Prime Coat if needed on raw block.
 - 3. 2 Coats: LX11-50 Series Loxon XP Waterproofing Masonry Coating Flat
 - 4. Colors as selected by Owner and Architect.
- C. Paint ME-OP-2A Ferrous Metals, Primed, Alkyd, 2 Coat:
 - 1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer equal to SW B50WZ0001 Kem Kromik Universal Metal Primer Off White.

- 2. Gloss: Two coats of alkyd enamel; equal to SW B54W00151 Industrial Urethane Alkyd Enamal Extra White.
- D. Paint MgE-OP-3A Galvanized Metals, Alkyd, 3 Coat:
 - 1. One coat galvanize primer Equal to SW B66W00310 Pro Industrial Pro Cryl Universal Primer Off White.
 - 2. Gloss: Two coats of alkyd enamel; Equal to SW B54W00151 Industial Urethane Alkyd Enamel Extra White.

2.04 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP All Interior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including gypsum board.
 - 1. Flat: MPI gloss level 1; use this sheen at all locations.
 - 2. Eggshell: MPI gloss level 3; use this sheen at all locations.
 - 3. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
 - 4. Primer(s): As recommended by manufacturer of top coats.
- B. Paint WI-OP-3L Wood, Opaque, Latex, 3 Coat:
 - 1. One coat of latex primer sealer equal to SW B51W00020 PrepRite ProBlock Int/Ext Latex Primer/Sealer White.
 - 2. Semi-gloss: Two coats of latex enamel; SW B31W02651 ProMar 200 Zero VOC Interior Latex Semi-Gloss Extra White.
 - 3. Eggshell: Two coats of latex enamel; [_____].
- C. Paint CI-OP-3L Concrete/Masonry, Opaque, Latex, 3 Coat:
 - 1. One coat of block filler equal to SW B25W00025 Preprite Block Filter White.
 - 2. Semi-gloss: Two coats of latex enamel; SW B31W02651 ProMar 200 Zero VOC Interior Latex Semi-Gloss Extra White.
- D. Paint MI-OP-3L Ferrous Metals, Unprimed, Latex, 3 Coat:
 - 1. One coat of latex primer equal to SW B66W00310 Pro Industrial Pro-Cryl Universal Primer Off White.
 - 2. Semi-gloss: Two coats of latex enamel; SW B31W00051 ProClassic WaterBorne Interior Acrylic Semi-Gloss Extra White.

- E. Paint MI-OP-2L Ferrous Metals, Primed, Latex, 2 Coat:
 - 1. Touch-up with latex primer.
 - 2. Semi-gloss: Two coats of latex enamel; SW B31W00051 ProClassic WaterBorne Interior Acrylic Semi-Gloss Extra White.
- F. Paint GI-OP-3L Gypsum Board/Plaster, Latex, 3 Coat:
 - 1. One coat of laytex primer sealer equal to SW B28W08200 ProMar 200 Interior Latex Primer White.
 - 2. Eggshell: Two coats of latex enamel; SW B20W2651 ProMar 200 Zero VOC Egshell Extra White.
 - 3. Flat: Two coats of latex enamel; SW B30W02651 ProMar 200 Zero VOC Interior Latex Flat Extra White.
- G. Sealed Concrete Floor
 - Provide general polymers 3477 or approved equal, water based clear epoxy, fully breathable, three (3) coats 4 mils WFT each coat, 0 VOC, provide sumittal to include written letter from manufacturer approving installer, Install per manufacturer's instructions. ASTM 84/NFDA 255
- H. Dry Fall Paint:
 - 1. Paint ME- OP- 2A Ferrous Metals, Primed, Laytex, 2 Coat (Dry Fall)
 - a. Gloss: Two coats of Acrylic Primer and Finish Coats: Equal to SW B66W00501 - Pro Industrial Multi - Surface Acrylic Gloss Extra White
 - 2. Paint MgE-OP-3A Galvanized Metal Laytex, 2 Coat (Dry Fall)
 - a. Gloss: Two coats of Acrylic Primer and Finish Coats: Equal to SWB66W00501 - Pro Industrial Multi Surface Acrylic Gloss Extra White
 - 3. Refer to A7.7-A7.11. Provide paint to match dry fall paint(s) above for all surfaces indicated. Provide paint system as recommened by paint manufacturer for materials/surfaces to be painted.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.
- B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Commencement of paint operations indicates applicators acceptance of surfaces and conditions.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - Gypsum Wallboard: 12 percent. 1.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - Interior Wood: 15 percent, measured in accordance with ASTM D4442. 3.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to coating application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

- G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).
- J. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
- K. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
- L. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- M. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance.
- D. Sand wood surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finished coatings until completion of project.
- B. Touch-up damaged coatings after Substantial Completion.

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguisher brackets.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide color and finish, anchorage details, and installation instructions.
- C. Shop Drawings: Indicate locations of individual fire extinguishers, mounting measurements for wall bracket, installation procedures, and accessories required for complete installation.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguisher Accessories:
 - 1. Wall Bracket.
 - Amerex, Model 889 Forked Wall Bracket (Basis of Design). Install at each a. fire extinguisher location.
 - Ansul, a Tyco Business; []: www.ansul.com/#sle. b.
 - c. JL Industries, Inc; []: www.jlindustries.com.
 - d. Kidde, a unit of United Technologies Corp; []: www.kidde.com/#sle.
 - Larsen's Manufacturing Co; []: www.larsensmfg.com/#sle. e.

f. Nystrom, Inc; [____]: www.nystrom.com/#sle.

2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install wall mounting brackets plumb and level, 69 inches (1524 mm) from finished floor to top of extinguisher, maximum. Final height to be coordinated on with with Owner and Architect.
- C. Secure rigidly in place.
- D. Provide fire extinguisher identification signage and posisition above fire extinguisher bracket at each fire extinguisher location..
- E. Final location of extinguisher brackets and signage to be selected on site by Owner and Architect.

PART 1 - GENERAL

1.01 Related Documents

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, shall apply to work specified in this section.

1.02 General Description of Work

A. Work in this section shall include design, fabrication and installation of complete welded, extruded aluminum canopy system. All work shall be in complete accordance with the drawings and this specification.

1.03 References

- A. Aluminum Design Manual 2000, Specifications & Guidelines for Aluminum Structures.
- B. ASCE 7, Minimum Design Loads for Buildings and Other Structures.
- C. American Architectural Manufacturers Association (AAMA)
- D. American Society for Testing and Materials (ASTM)

1.04 Related Sections

- A. Concrete Work Section 03 3000
- B. Masonry Work Section 04 2000
- C. Metal Fabrications- Section 05 5000
- D. Sheet Metal and Trim Section 07 6200
- E. Joint Sealants Section 07 9005

1.05 Submittals

- A. Product Data: Submit manufacturer's product information, specifications and installation instructions for components and accessories.
- B. Shop Drawings: Submit complete erection drawings showing attachment system, column and gutter beam framing, transverse cross sections, covering and trim details, and option installation details to clearly indicate proper assembly of components. Detailed shop drawings shall be submitted, sealed by a State Registered Structural

Engineer.

- C. Certification: Submit written Certification prepared and signed by a State Registered Structural Engineer verifying that framing design will safely resist wind uplift as computed by ANSI A58.1, IV=150, Exposure C, as well as meet indicated loading requirements of all applicable building codes for project location, latest edition as referenced in State Requirements for Educational Facilities 1999 and wind loading requirements of ANSI/ASCE 7-98, live and dead loads and other load requirements.
- D. Design and engineering of footers and attachment surfaces are not covered in this specification and scope of work.

1.06 Quality Assurance

- A. Codes and standards: Comply with provisions of the following except as otherwise indicated: all applicable building codes for location project, latest addition with amendments, if any. AWS (American Welding Society) standards for structural aluminum welding.
- B. Manufacturer: Obtain aluminum covered walkway system from only one (1) manufacturer, although several may be indicated as offering products complying with requirements.
- C. Installer Qualifications: Firm with not less than three (3) years experience in installation of aluminum walkway covers of type, quantity and installation methods similar to work of this section.
- D. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to insure proper fitting of work.
- E. Coordination: Coordinate work of this section with work of other sections which interface with covered walkway system (sidewalk, curbs, building fascias, etc.).

1.07 Warranty

A. Provide manufactures standard ten (10) year warranty that shall include, but not limited to, coverage for structural, water tightness and finish beginning the day of Final Completion.

PART 2 - PRODUCT

2.01 Manufacturers

- A. Contract documents are based on products manufactured by:
 - 1. Tennessee Valley Metals, Inc., or equal.

2720 Southeastern Circle Birmingham, AL 35215 205.853.1125 fax 205.853.1314 800.551.2579 sales@tvmetals.com www.tvmetals.com

B. Interested manufacturers will be considered for per Division 01 Requirements.

2.02 Materials

- A. Aluminum Extrusions: All sections shall be extruded aluminum 6063 alloy, heat treated to T-6 temper. with Kynar Finish
- B. Sheet Metal Flashing and Trim: .032 Aluminum with Kynar Finish
- C. Finishes: Standard or custom color as selected ny architect
 - 1. For flouroplymer (Kynar) finish, specify AAMA 605.2, two or three coats
- D. Submit color samples for Owner and Architect's approval. Do not place order with manufacturer until receipt of written authorization from Owner approving color and design.

2.03 COMPONENTS, all with Kynar or equal finish

- A. Columns: Columns shall be radius cornered tubular extrusion of size shown on drawings with cutout and internal diverter for drainage where indicated. Circular downspout opening in column is not acceptable.
- B. Beams: Beams shall be open-top tubular extrusion of size and shape shown on drawings, top edges thickened for strength and designed to receive deck members in self-flashing manner. Structural ties shall be installed in tops of all beams.
- C. Deck: Deck shall be extruded self-flashing sections interlocking into a composite nit.
- D. Fascia: Fascia shall be manufacturer's standard shape. Size as indicated on drawings.
- E. Flashing: Flashing shall be .032 aluminum (min.). All thru-wall flashing is completed by others.

F. Arches: Arches for barrel vault protective covers shall be sharp-cornered tubular extrusions of size shown in drawings.

2.04 Fabrication

- A. Drainage: Water shall drain internally from deck to beams to columns, for discharge out to rain diverters at or below ground level as indicated on architectural drawings.
- B. Deck Construction: Deck shall be manufactured of extruded modules that interlock in a self-flashing manner. Interlocking joints shall be positively fastened at 18" O.C. creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each. Deck shall be assembled with sufficient camber to offset dead load deflection.

PART 3 - EXECUTION

3.01 Preparation

A. Erection shall be performed after all concrete, masonry, and roofing work in the vicinity is complete and cleaned.

3.02 Installation

- A. Column Sleeves: Column sleeves (Styrofoam blockouts) or anchor bolts (if required) shall be furnished by canopy manufacturer and installed by the General Contractor.
- B. Erection: Protective cover shall be erected true to line, level and plumb.

3.03 Cleaning

A. All protective cover components shall be cleaned promptly after installation.

3.04 Protection

A. Extreme care shall be taken to protect materials during and after installation.
PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufacturer-engineered, shop-fabricated structural steel building frame.
- B. Metal wall and roof panels including gutters and downspouts.
- C. Coordination of exterior doors, windows, and louvers.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 05 5000 Metal Fabrications.
- C. Section 07 9005 Joint Sealers.
- D. Section 08 1113 Hollow Metal Doors and Frames.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M Standard Specification for Carbon Structural Steel 2019.
- B. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- D. ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength 2014.
- E. ASTM A325M Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric) 2014.
- F. ASTM A500/A500M Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- G. ASTM A501/A501M Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.
- H. ASTM A529/A529M Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality 2019.
- I. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

- J. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- K. ASTM C920 Standard Specification for Elastomeric Joint Sealants 2018.
- L. ASTM C1107/C1107M Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2020.
- M. ASTM F3125/F3125M Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2019, with Editorial Revision (2020).
- N. AWS A2.4 Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.
- O. IAS AC472 Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems 2018.
- P. SSPC-Paint 20 Zinc-Rich Coating (Type I Inorganic, and Type II Organic) 2019.

1.04 DESIGN REQUIREMENTS

- A. Installed Thermal Resistance of Wall System: R value of 19 (RSI value of [____]).
- B. Installed Thermal Resistance of Roof System: R value of 30 (RSI value of [____]).

1.05 SYSTEM PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal building systems capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Engineer metal building systems according to procedures in MBMA's "Metal Building Systems Manual."
 - 2. Design Loads: As indicated on Drawings, as minimum.
 - Design Loads: As required by MBMA's "Metal Building Systems Manual." AISC Standards, IBC 2015.
 - 4. Live Loads: Include vertical loads induced by the building occupancy indicated on Drawings. Include loads induced by maintenance workers, materials, and equipment for roof live loads.
 - 5. Wind Loads: Include horizontal loads induced by a basic wind speed corresponding to a 10-year, mean-recurrence interval at project site as required by

code. See drawings for minimum design wind load.

- 6. Collateral Loads: Include additional dead loads other than the weight of metal building system for permanent items such as sprinklers, mechanical systems, electrical systems, and ceilings.
- 7. Load Combinations: Design metal building systems to withstand the most critical effects of load factors and load combinations as required by MBMA, AISC and IBC 2015.
- 8. Deflection Limits: Engineer assemblies to withstand design loads with deflections no greater than the following:
 - a. Purlins and Rafters: Vertical deflection of 1/240 of the span.
 - b. Girts: Horizontal deflection of 1/240 of the span.
- 9. Design secondary framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.
- B. Seismic Performance: Design and engineer metal building systems capable of withstanding the effects of earthquake motions determined according to IBC'09

1.06 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.07 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on profiles, component dimensions, fasteners.
- C. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage, installation; framing anchor bolt settings, sizes, and locations from datum, foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature for the state where project is located.
- D. Samples: Submit two samples of precoated metal panels for each color selected,
 _2_by_2_ inch (___by__ mm) in size illustrating color and texture of finish.
- E. Manufacturer Qualification Statement: Provide documentation showing metal building manufacturer is accredited under IAS AC472. Include statement that manufacturer designs and fabricates metal building system as integrated components and assemblies, including but not limited to primary structural members, secondary members, joints,

roof, and wall cladding components specifically designed to support and transfer loads and properly assembled components form a complete or partial building shell.

- F. Manufacturer's Instructions: Indicate preparation requirements, anchor bolt placement, and all other information for correct and complete erection and installation of all componenets.
- G. Manufacturer Qualification Statement: Provide documentation showing metal building manufacturer is accredited under IAS AC472.
 - 1. Include statement that manufacturer designs and fabricates metal building system as integrated components and assemblies, including but not limited to primary structural members, secondary members, joints, roof, and wall cladding components specifically designed to support and transfer loads and properly assembled components form a complete or partial building shell.
- H. Project Record Documents: Record actual locations of concealed components and utilities.
- I. Samples for Verification: For each type of exposed finish required, prepared on Samples of sizes indicated below.
 - 1. Accessories: Nominal 12 inch long Samples for each type of accessory.
- J. Product Certificates: For each type of metal building system, signed by product manufacturer.
 - 1. Letter of Design Certification: Signed and sealed by a qualified professional engineer licensed to practice in the State of Alabama. Include the following:
 - a. Name and location of Project.
 - b. Order number.
 - c. Name of manufacturer.
 - d. Name of Contractor.
 - e. Building dimensions including width, length, height, and roof slope.
 - f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 - g. Governing building code and year of edition.
 - h. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or

effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).

- i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
- j. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- k. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.
- K. Welding certificates.
- L. Erector Certificate: Signed by manufacturer certifying that erector complies with the following requirements:
 - 1. Qualification Data: Installation of the metal roofing panel and roof related accessories shall be performed by roofers, preferred, certified and authorized by the manufacturer as trained and qualified to erect the manufacturer's product. Certification of the contractor cannot exceed 3 years from date of original certification without proof of re-certification from the manufacturer. Roofing contractor must provide a certified project manager, full time, throughout the duration of the roofing installation. The project manager will represent the certification program provided by the manufacturer, representing the correct standards and procedures as detailed by the manufacturers specifications and designs.
 - 2. Roofing contractor must submit a letter from the manufacturer of the standing seam metal roofing system, certifying the date of certification from the manufacturer and the dates and year the roofing contractor attended school for certification or re-certification.
 - 3. Maintain a minimum of \$1,000,000 general liability coverage for each loss and/or provide Certificate of Insurance for Full Value of the project as directed by the Architect/Owner or Owner representative.
 - 4. Maintain sufficient worker's compensation coverage as mandated by law.
 - 5. Have no viable claims pending, regardless of negligent acts, defective workmanship on previously performed or current projects.
 - 6. Have not filed for protection from creditors under any state or federal insolvency or debtor relief statues or codes.

- Have installed five (5) projects of similar scope and magnitude that have been in service for minimum of 2 years with satisfactory performance of the entire roof system.
- 8. Installer must execute 100% of roof system installation, utilizing employees that are confirmed as full time employees of the contractor. Second and third tier subcontractors for the installation of the work in this section shall not be permitted.
- 9. Installer shall be identified as "primary source of business" for standing seam metal roof system.
- M. Material Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Nonshrink grout.
- N. Source quality-control test reports.

1.08 QUALITY ASSURANCE

- A. Erector Qualifications: An experienced erector who has specialized in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- B. Manufacturer Qualifications: A qualified manufacturer and member of MBMA and AISC.
 - 1. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility.
 - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer licensed in the State of Alabama. Affix engineering seal to all shop drawings and calculations and submit to architect.
- C. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing surveying services of the kind indicated.

- D. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- E. Source Limitations: Obtain primary metal building system components, including structural framing and metal panel assemblies, through one source from a single manufacturer.
- F. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal building system and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- G. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- H. Structural Steel: Comply with AISC's "Specification for Structural Steel Buildings--Allowable Stress Design, Plastic Design," or AISC's "Load and Resistance Factor Design Specification for Structural Steel Buildings," for design requirements and allowable stresses.
- I. Cold-Formed Steel: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members," or AISI's "Load and Resistance Factor Design Specification for Steel Structural Members," for design requirements and allowable stresses.

1.09 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to reapir or replace components of metal roof panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including rupturing, cracking or puncturing.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty period: Twenty (20) years from date of Substantial Completion.
 - 3. Metal roof and wall panel warranties to be able to transfer a minumum of once and have No Dollar Limit.

- 4. Standard manufacturer's roofing guarantees which contain language regarding the governing of the guarantee by any state other than the State of Alabama, must be amended to exclude such language, and substituting the requirement that teh Laws of the State of Alabama shall govern all such guarantees.
- C. Special Warranty on panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or reaplace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: Thirty Five (35) years from date of Substantial Completion.
 - 2. Standard manufacturer's roofing guarantees which contain language regarding the governing of the guarantee by any state other than the State of Alabama, must be amended to exclude such language, and substituting the requirement that the Laws of the State of Alabama shall govern all such guarantees.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Buildings:
 - 1. Butler Manufacturing Company; [____]: www.butlermfg.com/#sle.
 - 2. Ceco Building Systems; [____]: www.cecobuildings.com/#sle.
 - 3. Chief Buildings; [____]: www.chiefbuildings.com/#sle.
 - 4. Kirby Building Systems; [____]: www.kirbybuildingsystems.com/#sle.
 - 5. Metallic Building Company; [____]: www.metallic.com/#sle.
 - 6. Nucor Building Systems; [____]: www.nucorbuildingsystems.com/#sle.
 - 7. VP Buildings; [____]: www.vp.com/#sle.
 - 8. ACI Building Systems
 - 9. Vulcan Steel Structures
 - 10. American Buildings Company
 - 11. United Steel Structures of America
 - 12. Substitutions: See Section 01 6000 Product Requirements.

2.02 METAL BUILDING

- A. Single span rigid frame.
- B. Primary Framing: Rigid frame of rafter beams and columns, canopy beams, and wind bracing.
- C. Secondary Framing: Purlins, and other items detailed.
- D. Wall System: Preformed metal panels of horizontal profile, with sub-girt framing/anchorage assembly and insulation, and accessory components.
- E. Roof System: Preformed metal panels oriented parallel to slope, with sub-girt framing/anchorage assembly, insulation, and liner panels, and accessory components.
- F. Roof Slope: 1 inches in 12 inches ([____]).

2.03 MATERIALS - FRAMING

- A. Structural Steel Members: ASTM A36/A36M.
- B. Structural Tubing: ASTM A500/A500M Grade B cold-formed.
- C. Plate or Bar Stock: ASTM A529/A529M, Grade 50.
- D. Anchor Bolts: ASTM A307, galvanized to ASTM A153/A153M.
- E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1; galvanized to ASTM A153/A153M.
- F. Welding Materials: Type required for materials being welded.
- G. Primer: SSPC-Paint 20 zinc rich.
- H. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents.
 - Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch (13.7 MPa).
 - Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch (48 MPa).

2.04 MATERIALS - WALLS AND ROOF

- A. Roof Panel
 - 1. Concealed Finish: ASTM D 1005 Backer .5 mils minimum PVDF thickness.
 - 2. Standing Seam Roof Panels equalt to Butler MR-24. Exposed fasteners are not acceptable, unless the owner gives written approval otherwise.

- 3. Comply with ASHRAE 90.1, provide thermal blocks as required between framing and roof system.
- 4. Insulation: Double Layer Banded Insulation System (Total R Value = R-29)
 - a. (From outside to inside)
 - b. Provide thermal space block. Prior to installation of materials, contractor to allow architect to field verify thermal block installation.
 - c. Top Layer Unfaced insulation over purlins, R-10
 - d. Bottom Layer: Vinyl-faced insulation between purlins, R-19, white
 - 1) Vinyl faced insulation to have 2 vinyl tab extensions of 12" minimum each for overlapping Z purlin.
 - 2) Contractors option to substitute bottom layer insulation with unfaced insulation between purlins, R-19, and provide continuous vinyl liner below bottom layer of insulation.
 - e. Banded steel support system, white. Attached per manufacturers requirements.
 - f. Insulation shall be Type II NAIMA 202-96 certified
 - g. Flame spread index of 25 or less where exposed.
- B. Exterior Wall Panel: Equal to Butler Rib II, 24 gauge.
 - 1. Finishes equal to BUTLER RIB II Kynar 500 fluoropolymer.
 - 2. Insulation: Vinyl-faced insulation over girts, R-19
 - a. Provide thermal space block. prior to installation of materials, contractor to allow architect to field verify thermal block installation.
 - b. Insulation shall be Type II NAIMA 202-96 certified
 - c. Flame spread index of 25 or less where exposed.
- C. Joint Seal Gaskets: Manufacturer's standard type.
- D. Fasteners: Manufacturer's standard type, galvanized to comply with requirements of ASTM A153/A153M, finish to match adjacent surfaces when exterior exposed.
- E. Bituminous Paint: Asphaltic type.

- F. Sealant: ASTM C920, elastomeric sealant with movement capability of at least plus/minus 50 percent; 100 percent silicone; for exposed applications, match adjacent colors as closely as possible.
- G. Trim, Closure Pieces, Caps, Flashings, Gutters, Downspouts, Rain Water Diverter, Fascias, and Infills: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
- H. Plumbing Vent Flashing Aluminum bonded to Aluminum flange equal to BUTLER.
- I. Ridge Cap Continuous non-ventilating, equal to Butler.

2.05 ACCESSORY COMPONENTS

A. Translucent roof panels as shown on Roof Plans designed to fit in manufacturers roof system.

2.06 FABRICATION - FRAMING

- A. Hot-Rolled structural shapes: Comply with requirements of ASTM A36 or A529
- B. Tubing or Pipe: Comply with requirements of ASTM A500, Grade B, ASTM A501
- C. Plate or Bar Stock: Provide 42,000 psi minimum yield strength. Comply with ASTM A529, A570
- D. Members fabricated from Cold Form: Comply with requirements for ASTM A307 as necessary for design loads and connections details.
- E. Pre-engineered frame shapes to be per architectural sections.
- F. Anchor Bolts: Formed with bent shank, assembled with template for casting into concrete.
- G. Provide framing for translucent panel openings.
- H. Provide wall opening framing for doors, windows, and other accessory components.
- I. Structural Framing General:
 - 1. Primary Framing: Shop fabricate framing components to indicated size and section with base plates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
 - a. Make shop connections by welding or by using high-strength bolts.

- b. Join flanges to webs of built-up members by a continuous submerged arc-welding process.
- c. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
- d. Weld clips to frames for attaching secondary framing members.
- e. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary structural members with specified primer after fabrication.
- 2. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with base plates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
 - a. Make shop connections by welding or by using non-high-strength bolts.
 - b. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary structural members with specified primer after fabrication.
- J. Primary Framing: Manufacturer's standard structural primary framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 - 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - a. Slight variations in span and spacing may be acceptable if necessary to meet manufacturer's standard, as approved by Architect.
 - 2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
 - 3. Frame Configuration: See drawings.
 - 4. Exterior Column Type: See drawings.

- K. Secondary Framing: Manufacturer's standard secondary framing members, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Fabricate framing from cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet pre painted with coil coating, unless otherwise indicated, to comply with the following:
 - 1. Purlins: C- or Z-shaped sections; fabricated from minimum of 16ga thick steel sheet, built-up steel plates, or structural-steel shapes;
 - 2. Girts: C- or Z-shaped sections; fabricated from minimum of 16ga steel sheet, built-up steel plates, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees to flange and with minimum 2-1/2-inch-wide flanges.
 - 3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from 16ga steel sheet, built-up steel plates, or structural-steel shapes; to provide adequate backup for metal panels.
 - 4. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch diameter, cold-formed structural tubing to stiffen primary frame flanges.
 - 5. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
 - 6. Base or Sill Angles: Minimum 3-by-2-by-0.0598-inch zinc-coated (galvanized) steel sheet.
 - 7. Purlin and Girt Clips: Minimum 0.0598-inch thick, steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
 - 8. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from minimum 0.0598-inch- thick,
 - 9. Framing for Openings: Channel shapes; fabricated from minimum 0.0598-inchthick, cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings, and head, jamb, and sill of other openings.
 - 10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
- L. Canopy Framing: Manufacturer's standard structural-framing system, designed to withstand required loads, fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide frames with attachment plates and splice members, factory drilled for field-bolted assembly.
 - 1. Type: Straight Column

- M. Bracing: Provide adjustable wind bracing as follows:
 - 1. Rigid Portal Frames: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
- N. Bolts: Provide plain finish bolts for structural-framing components that are primed or finish painted. Provide zinc-plated bolts for structural-framing components that are galvanized.
- O. Factory-Primed Finish: Apply specified primer immediately after cleaning and pretreating.
 - 1. Prime primary, secondary, and end-wall structural-framing members to a minimum dry film thickness of 1 mil.
 - a. Prime secondary steel framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.
 - 2. Prime galvanized members with specified primer, after phosphoric acid pretreatment.

2.07 MISCELLANEOUS MATERIALS

- A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
 - 1. Fasteners for Metal Panels: Self-drilling Type 410 stainless-steel or self-tapping Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal panels.
 - 2. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
- B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- C. Metal Flashing, Gutters, Downspouts as specified in Section 07600. The Metal Building System Manufacturer shall supply these materials as part of the metal building systems.
- D. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

- E. Sheet Metal and Flashing.
- F. Personal Dood Canopies Equal to Metallic Products 1(8800)356-7746, www.mpvent.com or Design Components, Inc. - 1(800)868-9910, www.designcomponents.com
 - 1. Color as selected by Architect.

2.08 FABRICATION - GUTTERS AND DOWNSPOUTS

- A. Fabricate of same material and finish as roofing metal.
- B. Form gutters and downspouts and scuppers of standard profile and size indicated to collect and remove water. Fabricate with connection pieces.
- C. Form sections in maximum possible lengths. Hem exposed edges. Allow for expansion at joints.
- D. Fabricate support straps of same material and finish as roofing metal, color as selected.

2.09 FINISHES

- A. Framing Members: Clean, prepare, and shop prime. Do not prime surfaces to be field welded.
- B. Exterior Surfaces of Wall Components and Accessories: Precoated enamel on steel of modified silicone finish, [____] color as selected from manufacturer's standard range.
- C. Interior Surfaces of Wall Components and Accessories: Precoated enamel on steel of modified silicone finish, [____] color as selected from manufacturer's standard range.
- D. All exposed sturcture to be painted white. Refer to paint specificaiton 09 9000.
- E. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- F. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Erector present, for compliance with requirements for installation tolerances and other conditions affectin performance of work.
 - 1. For the record, prepare written report, endoresed by Erector, listing conditions detrimental to performance of work.
- B. Before erection proceeds, survey elevations and locations of concrete and masonrybearing surface and locations of anchor rods, bearing plates, and other embedments to receive structural frmaing, with Erector present, for compliance with requirements and metal building systems manfufactures tolerances.
 - 1. Engage land surveyor to perform surveying.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.02 ERECTION - FRAMING

- A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.

- 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing true to line, level, plumb, rigid, and secure. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist cure grout for not less than seven days after placement.
 - Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - a. Joint Type: Snug tightened or pretensioned.
- G. Secondary Framing: Erect framing true to line, level, plumb, rigid, and secure. Fasten secondary framing to primary framing using clips with field connections using non-high-strength bolts.
 - 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 - 2. Locate and space wall girts to suit openings such as doors and windows.
 - 3. Locate canopy framing as indicated.
 - 4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings, use portal frames where required.
 - 1. Locate interior end-bay bracing only where indicated or where approved by A/E.
- I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.03 ERECTION - WALL AND ROOF PANELS

- A. Install in accordance with manufacturer's instructions.
- B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.

- C. Fasten cladding system to structural supports, aligned level and plumb.
- D. Locate end laps over supports. End laps minimum 2 inches (50 mm). Place side laps over bearing.
- E. Provide expansion joints where indicated.
- F. Use concealed fasteners.
- G. Install sealant and gaskets, providing weather tight installation.

3.04 ACCESSORY INSTALLATION

- A. Rigidly support and secure components. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.
- B. Install splash pans under each downspout.
- C. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 2. Install components for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 3. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

3.05 INSTALLATION - ACCESSORY COMPONENTS IN WALL SYSTEM

- A. Install door frames, doors, overhead doors, and windows and glass in accordance with manufacturer's instructions.
- B. Seal wall and roof accessories watertight and weather tight with sealant in accordance with Section 07 9005.

3.06 TOLERANCES

- A. Framing Members: 1/4 inch (6 mm) from level; 1/8 inch (3 mm) from plumb.
- B. Siding and Roofing: 1/8 inch (3 mm) from true position.

3.07 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing and accessories.
 - Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or SSPC-SP 3, "Power Tool Cleaning."
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections. NOTE: Requirement to paint metal building components prior to installation of roof

END OF SECTION

SECTION 22 0510 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 22.

1.2 SUMMARY

- A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:
 - 1. Submittals.
 - 2. Coordination drawings.
 - 3. Record documents.
 - 4. Maintenance manuals.
 - 5. Rough-ins.
 - 6. Mechanical installations.
 - 7. Cutting and patching.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 22 Section "BASIC MECHANICAL MATERIALS AND METHODS," for materials and methods common to the remainder of Division 22, plus general related specifications including:
 - a. Access to mechanical installations.

1.3 SUBMITTALS

- A. General: Follow the procedures specified in Division 1 Section "SUBMITTALS."
- B. Increase, by the quantity listed below, the number of mechanical related shop drawings, product data, and samples submitted, to allow for required distribution plus two copies of each submittal required, which will be retained by the Mechanical Consulting Engineer.
 - 1. Shop Drawings Initial Submittal: 1 additional blue- or black-line prints.
 - 2. Shop Drawings Final Submittal: 1 additional blue- or black-line prints.
 - 3. Product Data: 1 additional copy of each item.
 - 4. Samples: 1 addition as set.
- C. Additional copies may be required by individual sections of these Specifications.

1.4 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, indicate the following installed conditions:
 - 1. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - 2. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
 - 3. Contract Modifications, actual equipment and materials installed.

1.5 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, include the following information for equipment items:
 - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - 2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
 - 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 4. Servicing instructions and lubrication charts and schedules.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.7 WARRANTIES

A. Warranties shall begin at date of final completion. All compressors shall include a minimum of five years warranty. One year warranty for labor, parts, units, etc. is required for all equipment. Additionally, Contractor is responsible for all preventative maintenance and routine service on installed equipment for the one year warranty period in order to maintain all factory/manufacturer warranties.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

3.2 MECHANICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
 - 1. Coordinate mechanical systems, equipment, and materials installation with other building components.
 - 2. Verify all dimensions by field measurements.
 - 3. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 - 4. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 - 5. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 - 6. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 - 7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
 - 8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 - 9. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
 - Install access panel or doors where units are concealed behind finished surfaces. Access panels
 and doors are specified in Division 8 Section "ACCESS DOORS" and Division 22 Section
 "BASIC MECHANICAL MATERIALS AND METHODS."

11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.3 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:
 - 1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 - 1. Uncover Work to provide for installation of ill-timed Work.
 - 2. Remove and replace defective Work.
 - 3. Remove and replace Work not conforming to requirements of the Contract Documents.
 - 4. Remove samples of installed Work as specified for testing.
 - 5. Install equipment and materials in existing structures.
 - 6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
- C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.
- D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 - 1. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
 - 2. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION

SECTION 22 0511 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and the Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following basic mechanical materials and methods to complement other Division 22 Sections.
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Concrete equipment base construction requirements.
 - 3. Equipment nameplate data requirements.
 - 4. Labeling and identifying mechanical systems and equipment is specified in Division 22.
 - 5. Nonshrink grout for equipment installations.
 - 6. Field-fabricated metal and wood equipment supports.
 - 7. Installation requirements common to equipment specification Sections.
 - 8. Mechanical demolition.
 - 9. Cutting and patching.
 - 10. Touchup painting and finishing.

1.3 DEFINITIONS

- A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.
- B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

- E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate mechanical equipment installation with other building components.
- B. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.
- D. Coordinate connection of electrical services.
- E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

1.6 WARRANTIES

A. Warranties shall begin at date of substantial completion. All compressors shall include a minimum of five years warranty. One year warranty for labor, parts, units, etc. is required for all equipment. Additionally, Contractor is responsible for all preventative maintenance and routine service on installed equipment for the one year warranty period in order to maintain all factory/manufacturer warranties.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

- A. Refer to individual piping system specification Sections for pipe and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual piping system specification Sections in Division 22 for special joining materials not listed below.
- B. Solder Filler Metal: ASTM B 32.
 - 1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10 percent lead content.
 - 2. Alloy E: Tin (approximately 95 percent) and copper (approximately 5 percent), having 0.10 percent maximum lead content.
 - 3. Alloy HA: Tin-antimony-silver-copper-zinc, having 0.10 percent maximum lead content.
 - 4. Alloy HB: Tin-antimony-silver-copper-nickel, having 0.10 percent maximum lead content.
- C. Brazing Filler Metals: AWS A5.8.
 - 1. BCuP Series: Copper-phosphorus alloys.
 - 2. BAg1: Silver alloy.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Solvent Cements: Manufacturer's standard solvents complying with the following:
 - 1. Chlorinated Poly(Vinyl Chloride) (CPVC): ASTM F 493.
 - 2. Poly(Vinyl Chloride) (PVC): ASTM D 2564.
- F. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.
- G. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end pressure pipes.
 - 1. Sleeve: ASTM A 126, Class B, gray iron.
 - 2. Followers: ASTM A 47 (ASTM A 47M), Grade 32510 or ASTM A 536 ductile iron.
 - 3. Gaskets: Rubber.
 - 4. Bolts and Nuts: AWWA C111.
 - 5. Finish: Enamel paint.

2.3 IDENTIFYING DEVICES AND LABELS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 22 Sections. Where more than one type is specified for listed application, selection is Installer's option, but provide single selection for each product category.
- B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped, permanently fastened to equipment.
 - 1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
 - 2. Location: An accessible and visible location.
- C. Stencils: Standard stencils, prepared for required applications with letter sizes conforming to recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4-inch (30mm) -high letters for ductwork and not less than 3/4-inch (19mm) -high letters for access door signs and similar operational instructions.
 - 1. Material: Brass.
 - 2. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
 - 3. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.
- D. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

2.4 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.50MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory-packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS--COMMON REQUIREMENTS

A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 22 specify piping installation requirements unique to the piping system.

- B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.
- C. Install components having pressure rating equal to or greater than system operating pressure.
- D. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- E. Install piping free of sags and bends.
- F. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.
- G. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- H. Install piping to allow application of insulation plus 1-inch (25mm) clearance around insulation.
- I. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- J. Install fittings for changes in direction and branch connections.
- K. Install couplings according to manufacturer's printed instructions.
- L. Sleeves are not required for core drilled holes.
- M. Permanent sleeves are not required for holes formed by PE plastic (removable) sleeves.
- N. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.
 - 2. Install large enough sleeves to provide 1/4-inch (6mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than 6 inches (150 mm).
 - 3. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified in Division 7 Section "Joint Sealants."
- O. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical

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sleeve seals. Size sleeve for 1-inch (25mm) annular clear space between pipe and sleeve for installation of mechanical seals.

- 1. Install steel pipe for sleeves smaller than 6 inches (150 mm).
- 2. Install cast-iron wall pipes for sleeves 6 inches (150 mm) and larger.
- 3. Assemble and install mechanical seals according to manufacturer's printed instructions.
- P. Below Grade, Exterior Wall, Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.
- Q. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material. Firestopping materials are specified in Division 7 Section "Firestopping."
- R. Verify final equipment locations for roughing in.
- Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.
 - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - 3. Soldered Joints: Construct joints according to AWS "Soldering Manual," Chapter 22 "The Soldering of Pipe and Tube."
 - 4. Brazed Joints: Construct joints according to AWS "Brazing Manual" in the "Pipe and Tube" chapter.
 - 5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
 - a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
 - c. Align threads at point of assembly.
 - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- T. Piping Connections: Except as otherwise indicated, make piping connections as specified below.
 - 1. Install unions in piping 2 inches (50 mm) and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch (50mm) or smaller threaded pipe connection.

2. Wet Piping Systems (Water and Steam): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION--COMMON REQUIREMENTS

- A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
- D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
- E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.3 LABELING AND IDENTIFYING

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
 - 1. Stenciled Markers: Complying with ASME A13.1.
- B. Equipment: Install engraved plastic laminate sign or equipment marker on or near each major item of mechanical equipment.
 - 1. Lettering Size: Minimum 1/4-inch (6mm) -high lettering for name of unit where viewing distance is less than 2 feet (0.6 m), 1/2-inch (13mm) -high for distances up to 6 feet (1.8 m), and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.
 - 2. Text of Signs: Provide text to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to name of identified unit.
- C. Adjusting: Relocate identifying devices which become visually blocked by work of this Division or other Divisions.

3.4 PAINTING AND FINISHING

A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 DEMOLITION

- A. Disconnect, demolish, and remove work specified under Division 22 and as indicated.
- B. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
- C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.
- D. Abandoned Work: Cut and remove buried pipe abandoned in place, 2 inches (50 mm) beyond the face of adjacent construction. Cap and patch surface to match existing finish.
- E. Removal: Remove indicated equipment from the Project site.
- F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.6 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.
- B. Repair cut surfaces to match adjacent surfaces.

3.7 GROUTING

- A. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms for placement of grout, as required.
- D. Avoid air entrapment when placing grout.
- E. Place grout to completely fill equipment bases.
- F. Place grout on concrete bases to provide a smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout according to manufacturer's printed instructions.

END OF SECTION

SECTION 22 0513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable-Frequency Controllers:
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
 - 2. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 22 0517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.
 - 6. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. GPT; an EnPro Industries company.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.

- C. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.
- D. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- E. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
- F. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- G. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

- A. Description: Manufactured, Dura-coated or Duco-coated galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

- A. Description:
 - 1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 2. Designed to form a hydrostatic seal of 20 psig minimum.
 - 3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 4. Pressure Plates: Carbon steel.
 - 5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633, Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.
- B. Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.
- C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 - 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 3. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.

- 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
- 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 07 8413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 6200 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Use silicone sealant to seal the space around outside of stack-sleeve fittings.
- B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

- C. Secure nailing flanges to concrete forms.
- D. Use grout or silicone sealant to seal the space around outside of sleeve-seal fittings.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves.
 - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 4. Concrete Slabs above Grade:

- a. Piping Smaller Than NPS 6: Steel pipe sleeves.
- b. Piping NPS 6 and Larger: Steel pipe sleeves.
- 5. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION

SECTION 22 0518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.3 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. BrassCraft Manufacturing Co.; a Masco company.
 - 2. Dearborn Brass.
 - 3. Jones Stephens Corp.
 - 4. Keeney Manufacturing Company (The).
 - 5. Mid-America Fittings, Inc.
 - 6. ProFlo; a Ferguson Enterprises, Inc. brand.

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ESCUTCHEONS FOR PLUMBING PIPING

2.2 ESCUTCHEONS

- A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.
- C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
- E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
- F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed and exposed-rivet hinge; and spring-clip fasteners.

2.3 FLOOR PLATES

A. Split Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
 - b. Chrome-Plated Piping: One-piece steel with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.

- f. Bare Piping in Unfinished Service Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
- g. Bare Piping in Equipment Rooms: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One-piece, floor plate.
 - 2. Existing Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION

22 0518-3 ESCUTCHEONS FOR PLUMBING PIPING

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SECTION 22 0519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Bimetallic-actuated thermometers.
 - 2. Filled-system thermometers.
 - 3. Liquid-in-glass thermometers.
 - 4. Light-activated thermometers.
 - 5. Thermowells.
 - 6. Dial-type pressure gages.
 - 7. Gage attachments.
 - 8. Test plugs.
 - 9. Test-plug kits.
 - 10. Sight flow indicators.
- B. Related Requirements:
 - 1. Section 22 1113 "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
 - 2. Section 22 1119 "Domestic Water Piping Specialties" for water meters.
 - 3. Section 22 1513 "General-Service Compressed-Air Piping" for compressed air gages.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 **BIMETALLIC-ACTUATED THERMOMETERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ashcroft Inc.
 - 2. Nanmac Corporation.
 - 3. Trerice, H. O. Co.
 - 4. WATTS.
 - 5. Weiss Instruments, Inc.
 - 6. WIKA Instrument Corporation.
- B. Standard: ASME B40.200.
- C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch nominal diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.
- E. Connector Type(s): Union joint, adjustable angle rigid, back and rigid, bottom, with unifiedinch screw threads.
- F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- H. Window: Plain glass or plastic.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.

- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus or minus 1 percent of scale range.

2.2 FILLED-SYSTEM THERMOMETERS

- A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ashcroft Inc.
 - b. Trerice, H. O. Co.
 - c. Weiss Instruments, Inc.
 - 2. Standard: ASME B40.200.
 - 3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
 - 4. Element: Bourdon tube or other type of pressure element.
 - 5. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
 - 6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
 - 7. Pointer: Dark-colored metal.
 - 8. Window: Glass or plastic.
 - 9. Ring: Metal Stainless steel.
 - 10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device rigid, back and rigid, bottom; with ASME B1.1 screw threads.
 - 11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 - 12. Accuracy: Plus or minus 1 percent of scale range.
- B. Direct-Mounted, Plastic-Case, Vapor-Actuated Thermometers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ashcroft Inc.

- b. Miljoco Corporation.
- c. REOTEMP Instrument Corporation.
- 2. Standard: ASME B40.200.
- 3. Case: Sealed type, plastic; 4-1/2-inch nominal diameter.
- 4. Element: Bourdon tube or other type of pressure element.
- 5. Movement: Mechanical, with link to pressure element and connection to pointer.
- 6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
- 7. Pointer: Dark-colored metal.
- 8. Window: Glass or plastic.
- 9. Ring: Metal or plastic.
- 10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device rigid, back and rigid, bottom; with ASME B1.1 screw threads.
- 11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
- 12. Accuracy: Plus or minus 1 percent of scale range.
- C. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ashcroft Inc.
 - b. Trerice, H. O. Co.
 - c. Weiss Instruments, Inc.
 - d. WIKA Instrument Corporation.
 - 2. Standard: ASME B40.200.
 - 3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter with back flange and holes for panel mounting.
 - 4. Element: Bourdon tube or other type of pressure element.
 - 5. Movement: Mechanical, with link to pressure element and connection to pointer.

- 6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
- 7. Pointer: Dark-colored metal.
- 8. Window: Glass or plastic.
- 9. Ring: Metal Stainless steel.
- 10. Connector Type(s): Union joint, back; with ASME B1.1 screw threads.
- 11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
- 12. Accuracy: Plus or minus 1 percent of scale range.

2.3 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
 - 1. Standard: ASME B40.200.
 - 2. Case: Cast aluminum; 6-inch nominal size.
 - 3. Case Form: Back angle unless otherwise indicated.
 - 4. Tube: Glass with magnifying lens and blue or red organic liquid.
 - 5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
 - 6. Window: Glass or plastic.
 - 7. Stem: Aluminum or brass and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 - 8. Connector: 3/4 inch, with ASME B1.1 screw threads.
 - Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- B. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. WATTS.

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- b. Weiss Instruments, Inc.
- c. Weksler Glass Thermometer Corp.
- d. WIKA Instrument Corporation.
- 2. Standard: ASME B40.200.
- 3. Case: Plastic; 6-inch nominal size.
- 4. Case Form: Back angle unless otherwise indicated.
- 5. Tube: Glass with magnifying lens and blue or red organic liquid.
- 6. Tube Background: Nonreflective with permanently etched scale markings graduated in deg F and deg C.
- 7. Window: Glass or plastic.
- 8. Stem: Aluminum or brass and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
- 9. Connector: 3/4 inch, with ASME B1.1 screw threads.
- 10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- C. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - 1. Standard: ASME B40.200.
 - 2. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
 - 3. Case Form: Adjustable angle Straight unless otherwise indicated.
 - 4. Tube: Glass with magnifying lens and blue or red organic liquid.
 - 5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
 - 6. Window: Glass or plastic.
 - 7. Stem: Aluminum and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 - 8. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
 - 9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- D. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Marsh Bellofram.
 - b. WATTS.
 - c. Weiss Instruments, Inc.
 - d. Weksler Glass Thermometer Corp.
 - e. WIKA Instrument Corporation.
- 2. Standard: ASME B40.200.
- 3. Case: Plastic; 7-inch nominal size unless otherwise indicated.
- 4. Case Form: Adjustable angle unless otherwise indicated.
- 5. Tube: Glass with magnifying lens and blue or red organic liquid.
- 6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
- 7. Window: Glass or plastic.
- 8. Stem: Aluminum] Aluminum, brass, or stainless steel and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
- 9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
- 10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.4 LIGHT-ACTIVATED THERMOMETERS

2.5 THERMOWELLS

- A. Thermowells:
 - 1. Standard: ASME B40.200.
 - 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 - 3. Material for Use with Copper Tubing: CNR or CUNI.
 - 4. Material for Use with Steel Piping: CRES.
 - 5. Type: Stepped shank unless straight or tapered shank is indicated.

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6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.

- 7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
- 8. Bore: Diameter required to match thermometer bulb or stem.
- 9. Insertion Length: Length required to match thermometer bulb or stem.
- 10. Lagging Extension: Include on thermowells for insulated piping and tubing.
- 11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.6 PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ametek U.S. Gauge.
 - b. Trerice, H. O. Co.
 - c. WATTS.
 - d. Weiss Instruments, Inc.
 - e. Weksler Glass Thermometer Corp.
 - f. WIKA Instrument Corporation.
 - 2. Standard: ASME B40.100.
 - 3. Case: Liquid-filled Sealed Open-front, pressure relief type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
 - 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - 5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottomoutlet type unless back-outlet type is indicated.
 - 6. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
 - 8. Pointer: Dark-colored metal.
 - 9. Window: Glass or plastic.
 - 10. Ring: Metal Stainless steel.
 - 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

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2.7 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.8 TEST PLUGS

- A. Description: Test-station fitting made for insertion into piping tee fitting.
- B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- C. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
- D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- E. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.9 TEST-PLUG KITS

- A. Furnish one test-plug kit(s) containing one] thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- B. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.
- C. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch-diameter dial and probe. Dial range shall be at least 0 to 200 psig.
- D. Carrying Case: Metal or plastic, with formed instrument padding.

2.10 SIGHT FLOW INDICATORS

- A. Description: Piping inline-installation device for visual verification of flow.
- B. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.
- C. Minimum Pressure Rating: 150 psig.
- D. Minimum Temperature Rating: 200 deg F.
- E. End Connections for NPS 2 and Smaller: Threaded.

F. End Connections for NPS 2-1/2 and Larger: Flanged.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending one-third of pipe diameter to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install test plugs in piping tees.
- K. Install thermometers in the following locations:
 - 1. Inlet and outlet of each water heater.
 - 2. Inlets and outlets of each domestic water heat exchanger.
 - 3. Inlet and outlet of each domestic hot-water storage tank.
 - 4. Inlet and outlet of each remote domestic water chiller.
 - 5. .
- L. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Inlet and outlet of each pressure-reducing valve.
 - 3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F and minus 20 to plus 70 deg C.
- B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F and 0 to 150 deg C.

END OF SECTION

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SECTION 22 0523.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.
 - 3. Steel ball valves.
 - 4. Iron ball valves.
 - 5. CPVC ball valves.
 - 6. PVC ball valves.

1.3 **DEFINITIONS**

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and soldered ends.
 - 3. Set ball valves open to minimize exposure of functional surfaces.

- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B16.5 for flanges on steel valves.
 - 4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 5. ASME B16.18 for solder-joint connections.
 - 6. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
 - 2. Handlever: For quarter-turn valves smaller than NPS 4.
- H. Valves in Insulated Piping:

- 1. Include 2-inch stem extensions.
- 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
- 3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

- A. Brass Ball Valves, One-Piece:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.
 - d. Body Material: Forged brass or bronze.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Brass or stainless steel.
 - h. Ball: Chrome-plated brass or stainless steel.
 - i. Port: Reduced.
- B. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Threaded or Soldered Ends:
 - 1. Description:
 - a. Standard: MSS SP-110 or MSS SP-145.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.
- C. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Press Ends:
 - 1. Description:
 - a. Standard: MSS SP-110 or MSS SP-145.
 - b. CWP Rating: Minimum 200 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Forged brass.
 - e. Ends: Press.
 - f. Press Ends Connections Rating: Minimum 200 psig.
 - g. Seats: PTFE or RPTFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.

- j. Port: Full.
- k. O-Ring Seal: Buna-N or EPDM.
- D. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim, Threaded or Soldered Ends:
 - 1. Description:
 - a. Standard: MSS SP-110 or MSS SP-145.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Full.
- E. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim, Press Ends:
 - 1. Description:
 - a. Standard: MSS SP-110 or MSS SP-145.
 - b. CWP Rating: Minimum 200 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Forged brass.
 - e. Ends: Press.
 - f. Press Ends Connections Rating: Minimum 200 psig.
 - g. Seats: PTFE or RPTFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.
 - k. O-Ring Seal: Buna-N or EPDM.
- F. Brass Ball Valves, Two-Piece with Regular Port and Brass Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Regular.
- G. Brass Ball Valves, Two-Piece with Regular Port and Stainless-Steel Trim:

Northport FMS #9 Renovations Northport, AL

- 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Brass or bronze.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Regular.
- H. Brass Ball Valves, Three-Piece with Full Port and Brass Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Three piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.
- I. Brass Ball Valves, Three-Piece with Full Port and Stainless-Steel Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Three piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Full.

2.3 BRONZE BALL VALVES

- A. Bronze Ball Valves, One-Piece with Bronze Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.

- d. Body Material: Bronze.
- e. Ends: Threaded.
- f. Seats: PTFE.
- g. Stem: Bronze.
- h. Ball: Chrome-plated brass.
- i. Port: Reduced.
- B. Bronze Ball Valves, One-Piece with Stainless-Steel Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: One piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Reduced.
- C. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Threaded or Soldered Ends:
 - 1. Description:
 - a. Standard: MSS SP-110 or MSS-145.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Bronze or brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.
- D. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Press Ends:
 - 1. Description:
 - a. Standard: MSS SP-110 or MSS-145.
 - b. CWP Rating: Minimum 200 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Press.
 - f. Press Ends Connections Rating: Minimum 200 psig.
 - g. Seats: PTFE or RTPFE.
 - h. Stem: Bronze or brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

- k. O-Ring Seal: EPDM or Buna-N.
- E. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:
 - 1. Description:
 - a. Standard: MSS SP-110 or MSS-145.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded or soldered.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Full.
- F. Bronze Ball Valves, Two-Piece with Regular Port and Bronze or Brass Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Bronze or brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Regular.
- G. Bronze Ball Valves, Two-Piece with Regular Port and Stainless-Steel Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Regular.
- H. Bronze Ball Valves, Three-Piece with Full Port and Bronze or Brass Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.

- c. Body Design: Three piece.
- d. Body Material: Bronze.
- e. Ends: Threaded.
- f. Seats: PTFE.
- g. Stem: Bronze or brass.
- h. Ball: Chrome-plated brass.
- i. Port: Full.
- I. Bronze Ball Valves, Three-Piece with Full Port and Stainless-Steel Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Three piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Full.
- J. Bronze Ball Valves, Three-Piece with Regular Port and Bronze Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Three piece
 - d. Body Material: Bronze
 - e. Ends: Threaded or soldered.
 - f. Seats: PTFE.
 - g. Stem: Bronze.
 - h. Ball: Chrome-plated brass.
 - i. Port: Regular.
- K. Bronze Ball Valves, Three-Piece with Regular Port and Stainless-Steel Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Three piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded or soldered.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Regular.

- L. Bronze Ball Valves, Two-Piece, Safety-Exhaust:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze, ASTM B584, Alloy C844.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Chrome-plated brass, with exhaust vent opening for pneumatic applications.
 - i. Port: Full.

2.4 STEEL BALL VALVES

- A. Steel Ball Valves with Full Port, Class 150:
 - 1. Description:
 - a. Standard: MSS SP-72.
 - b. CWP Rating: 285 psig.
 - c. Body Design: Split body.
 - d. Body Material: Carbon steel, ASTM A216, Type WCB.
 - e. Ends: Flanged or threaded.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Full.
- B. Steel Ball Valves with Regular Port, Class 150:
 - 1. Description:
 - a. Standard: MSS SP-72.
 - b. CWP Rating: 285 psig.
 - c. Body Design: Uni-body.
 - d. Body Material: Carbon steel, ASTM A216, Type WCB.
 - e. Ends: Flanged or threaded.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Regular.

2.5 IRON BALL VALVES

- A. Iron Ball Valves, Class 125:
 - 1. Description:

- a. Standard: MSS SP-72.
- b. CWP Rating: 200 psig.
- c. Body Design: Split body.
- d. Body Material: ASTM A126, gray iron.
- e. Ends: Flanged or threaded.
- f. Seats: PTFE.
- g. Stem: Stainless steel.
- h. Ball: Stainless steel.
- i. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install valve tags. Comply with requirements in Section 22 0553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

- B. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valveend option or press-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.4 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Brass ball valves, one piece.
 - 3. Bronze ball valves, one piece with bronze trim.
 - 4. Brass ball valves, two-piece with full port and stainless steel trim.
 - 5. Bronze ball valves, two-piece with full port and stainless steel trim.
 - 6. Brass ball valves, three-piece with full port and stainless steel trim.
 - 7. Bronze ball valve, three-piece with full port and bronze or brass trim.
 - 8. Bronze ball valves, two-piece with regular port and bronze trim.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 - 2. Steel ball valves, Class 150 with full port.
 - 3. Iron ball valves, Class 150.

HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG 3.5

A. Pipe NPS 2 and Smaller:

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- Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded 1. ends.
- 2. Brass ball valve.
- 3. Bronze ball valve, one piece with stainless steel trim.
- Brass ball valves, two-piece with full port and stainless steel trim. 4.
- Bronze ball valves, two-piece with full port and stainless steel trim. 5.
- 6. Brass ball valves, three-piece with full port and stainless steel trim.
- 7. Bronze ball valves, three-piece with full port and stainless steel trim.
- 8. Bronze ball valves, two-piece with regular port and stainless steel trim.
- B. Pipe NPS 2-1/2 and Larger:
 - Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead 1. of flanged ends.
 - 2. Steel ball valves, Class 150 with full port.
 - 3. Iron ball valves, Class 150.

3.6 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- Pipe NPS 2 and Smaller: A.
 - Brass ball valve, one piece. Provide with threaded or solder-joint ends. 1.
 - 2. Bronze ball valve, one piece with bronze trim. Provide with threaded or solder-joint ends.
 - Brass ball valves, two-piece with full port and stainless steel trim. Provide with threaded, 3. solder or press connection-joint ends.
 - Bronze ball valves, two-piece with full port and stainless steel trim. Provide with 4. threaded, solder or press connection-joint ends.
 - Brass ball valves, three-piece with full port and stainless steel trim. 5.
 - 6. Bronze ball valves, three-piece with full port and stainless steel trim.
 - Bronze ball valves, two-piece with regular port and stainless-steel trim. 7.

- B. Pipe NPS 2-1/2 and Larger:
 - 1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 - 2. Steel ball valves, Class 150 with full port.
 - 3. Iron ball valves, Class 150.

END OF SECTION
SECTION 22 0523.14 - CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Bronze lift check valves.
 - 2. Bronze swing check valves.
 - 3. Bronze swing check valves, press ends.
 - 4. Iron swing check valves.
 - 5. Iron swing check valves with closure control.
 - 6. Iron, grooved-end swing check valves.
 - 7. Iron, center-guided check valves.
 - 8. Iron, plate-type check valves.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene-diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61 and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set check valves in either closed or open position.

- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 4. ASME B16.18 for solder joint.
 - 5. ASME B31.9 for building services piping valves.
- C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- D. Drinking Water System Components Health Effects and Drinking Water System Components Lead Content Compliance: NSF 61 and NSF 372.
- E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- G. Valve Sizes: Same as upstream piping unless otherwise indicated.
- H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE LIFT CHECK VALVES

- A. Bronze Lift Check Valves with Bronze Disc, Class 125:
 - l.
- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig.
- c. Body Design: Vertical flow.

- d. Body Material: ASTM B61 or ASTM B62, bronze.
- e. Ends: Threaded or soldered. See valve schedule articles.
- f. Disc: Bronze.
- B. Bronze Lift Check Valves with Nonmetallic Disc, Class 125:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B61 or ASTM B62, bronze.
 - e. Ends: Threaded or soldered. See valve schedule articles.
 - f. Disc: NBR, PTFE.

2.3 BRONZE SWING CHECK VALVES

- A. Bronze Swing Check Valves with Bronze Disc, Class 125:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B62, bronze.
 - e. Ends: Threaded or soldered. See valve schedule articles.
 - f. Disc: Bronze.
- B. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B62, bronze.
 - e. Ends: Threaded or soldered. See valve schedule articles.
 - f. Disc: PTFE.
- C. Bronze Swing Check Valves with Bronze Disc, Class 150:
 - 1. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B62, bronze.
 - e. Ends: Threaded or soldered. See valve schedule articles.
 - f. Disc: Bronze.
- D. Bronze Swing Check Valves with Nonmetallic Disc, Class 150:
 - 1. Description:

- a. Standard: MSS SP-80, Type 4.
- b. CWP Rating: 300 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B62, bronze.
- e. Ends: Threaded or soldered. See valve schedule articles.
- f. Disc: PTFE.
- E. Bronze Swing Check Valves, Press Ends:
 - 1. Description:
 - a. Standard: MSS SP-80 and MSS SP-139.
 - b. CWP Rating: Minimum 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B584, bronze.
 - e. Ends: Press.
 - f. Press Ends Connection Rating: Minimum 200 psig
 - g. Disc: Brass or bronze.

2.4 IRON SWING CHECK VALVES

- A. Iron Swing Check Valves with Metal Seats, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A126, gray iron with bolted bonnet.
 - e. Ends: Flanged or threaded. See valve schedule articles.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.
- B. Iron Swing Check Valves with Nonmetallic-to-Metal Seats, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A126, gray iron with bolted bonnet.
 - e. Ends: Flanged or threaded. See valve schedule articles.
 - f. Trim: Composition.
 - g. Seat Ring: Bronze.
 - h. Disc Holder: Bronze.
 - i. Disc: PTFE.
 - j. Gasket: Asbestos free.
- C. Iron Swing Check Valves with Metal Seats, Class 250:

- 1. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 500 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A126, gray iron with bolted bonnet.
 - e. Ends: Flanged or threaded. See valve schedule articles.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.

2.5 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

- A. Iron Swing Check Valves with Lever- and Spring-Closure Control, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A126, gray iron with bolted bonnet.
 - e. Ends: Flanged or threaded. See valve schedule articles.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.
 - h. Closure Control: Factory-installed exterior lever and weight.
- B. Iron Swing Check Valves with Lever and Weight-Closure Control, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A126, gray iron with bolted bonnet.
 - e. Ends: Flanged or threaded. See valve schedule articles.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.
 - h. Closure Control: Factory-installed exterior lever and weight.

2.6 IRON, GROOVED-END SWING CHECK VALVES

- A. Iron, Grooved-End Swing Check Valves, 300 CWP:
 - 1. Description:
 - a. CWP Rating: 300 psig.
 - b. Body Material: ASTM A536, ductile iron.
 - c. Seal: EPDM.
 - d. Disc: Spring operated, ductile iron or stainless steel.

2.7 IRON, CENTER-GUIDED, SPRING-LOADED CHECK VALVES

- A. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A126, gray iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: Bronze.
- B. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A126, gray iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: Bronze.
- C. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 150:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: Bronze.
- D. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 150:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: Bronze.
- E. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 250:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 400 psig.
 - c. Body Material: ASTM A126, gray iron.

- d. Style: Compact wafer, spring loaded.
- e. Seat: Bronze.
- F. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 250:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 400 psig.
 - c. Body Material: ASTM A126, gray iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: Bronze.
- G. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 300:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 500 psig.
 - c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: Bronze.
- H. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 300:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 500 psig.
 - c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: Bronze.
- I. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A126, gray iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: EPDM or NBR.
- J. Iron Globe, Center-Guided Check Valves with Resilient Seat, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig.

- c. Body Material: ASTM A126, gray iron.
- d. Style: Globe, spring loaded.
- e. Ends: Flanged.
- f. Seat: EPDM or NBR.
- K. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 150:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: EPDM or NBR.
- L. Iron, Globe, Center-Guided Check Valves with Resilient Seat, Class 150:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: EPDM or NBR.
- M. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 250:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 400 psig.
 - c. Body Material: ASTM A126, gray iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: EPDM or NBR.
- N. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 300:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 500 psig.
 - c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: EPDM or NBR.
- O. Iron Globe, Center-Guided Check Valves with Resilient Seat, Class 300:
 - 1. Description:
 - a. Standard: MSS SP-125.

- b. CWP Rating: 500 psig.
- c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
- d. Style: Globe, spring loaded.
- e. Ends: Flanged.
- f. Seat: EPDM or NBR.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Check Valves: Install check valves for proper direction of flow.
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.
- F. Install valve tags. Comply with requirements in Section 22 0553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
 - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; or iron, center-guided, metal-seat or resilient-seat check valves.
 - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- C. End Connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered or press-ends.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged.
 - 4. For Steel Piping, NPS 2 and Smaller: Threaded.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded.
 - 6. For Steel Piping, NPS 5 and Larger: Flanged.
 - 7. For Grooved-End Copper Tubing and Steel Piping: Grooved.

3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

- A. Pipe NPS 2 and Smaller:
 - 1. Vertical, Upflow Applications Only: Bronze lift check valves with bronze nonmetallic disc, Class 125, with soldered or threaded end connections.
 - 2. Horizontal and Vertical Applications: Bronze swing check valves with bronze nonmetallic disc, Class 150, with soldered or threaded end connections.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron swing check valves with metalseats, Class 125, with threaded or flanged end connections.
 - 2. Iron, grooved-end swing check valves, 300 CWP.
 - 3. Iron, dual-plate check valves with metal resilient seat, Class 125, with threaded or flanged end connections.
 - 4. Iron, single-plate check valves with resilient seat, Class 125, with threaded or flanged end connections.

3.6 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze swing check valves with bronze disc, Class 125, with soldered or threaded end connections.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron swing check valves with nonmetallic-to-metal seats, Class 250, with threaded or flanged end connections.
 - 2. Iron, grooved-end swing check valves, 300 CWP.

END OF SECTION

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SECTION 22 0523.15 - GATE VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Bronze gate valves.
 - 2. Iron gate valves.
 - 3. CPVC gate valves.
 - 4. PVC gate valves.
 - 5. Chainwheels.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. NRS: Nonrising stem.
- C. OS&Y: Outside screw and yoke.
- D. RS: Rising stem.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61 and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.

- 2. Protect threads, flange faces, grooves, and weld ends.
- 3. Set gate valves closed to prevent rattling.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 4. ASME B16.18 for solder joint.
 - 5. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 and NSP 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. RS Valves in Insulated Piping: With 2-inch stem extensions.
- H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE GATE VALVES

- A. Bronze Gate Valves, NRS, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Material: Bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.
- B. Bronze Gate Valves, RS, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig.
 - c. Body Material: Bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.
- C. Bronze Gate Valves, NRS, Class 150:
 - 1. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 300 psig.
 - c. Body Material: Bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.
- D. Bronze Gate Valves, RS, Class 150:
 - 1. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 300 psig.
 - c. Body Material: Bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.

- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.
- E. Bronze Gate Valves, Press Ends:
 - 1. Description:
 - a. Standard: MSS SP-80 and MSS SP-139.
 - b. CWP Rating: Minimum 200 psig.
 - c. Body Material: Bronze with integral seat and union-ring bonnet.
 - d. Ends: Press.
 - e. Press Ends Connection Rating: Minimum 200 psig.
 - f. Stem: Brass or bronze rising.
 - g. Disc: Solid wedge; bronze.
 - h. Packing: Graphite.
 - i. Port: Full.
 - j. Handwheel: Malleable iron, bronze, or aluminum.

2.3 IRON GATE VALVES

- A. Iron Gate Valves, NRS, Class 150:
 - 1. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: Gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.
- B. Iron Gate Valves, OS&Y, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: Gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.
- C. Iron Gate Valves, NRS, Class 250:
 - 1. Description:
 - a. Standard: MSS SP-70, Type I.

- b. CWP Rating: 500 psig.
- c. Body Material: Gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Disc: Solid wedge.
- g. Packing and Gasket: Asbestos free.
- D. Iron Gate Valves, OS&Y, Class 250:
 - 1. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 500 psig.
 - c. Body Material: Gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

- E. Install chainwheels on operators for gate valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.
- F. Install valve tags. Comply with requirements in Section 22 0553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. Use gate valves for shutoff service only.
- B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- C. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

- A. Pipe NPS 2 and Smaller: Bronze gate valves, NRS, Class 150 with threaded ends.
- B. Pipe NPS 2-1/2 and Larger: Iron gate valves, NRS, Class 150 with flanged ends.

3.6 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG

- A. Pipe NPS 2 and Smaller: Bronze gate valves NRS, Class 150 with threaded ends.
- B. Pipe NPS 2-1/2 and Larger: Iron gate valves, NRS, Class 250 with flanged ends.

3.7 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze gate valves, NRS, Class 150 with threaded ends.
 - 2. Bronze gate valves, press ends.
- B. Pipe NPS 2-1/2 and Larger: Iron gate valves, NRS, Class 125 with flanged ends.

END OF SECTION

SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Fiberglass pipe hangers.
 - 4. Metal framing systems.
 - 5. Fiberglass strut systems.
 - 6. Thermal hanger-shield inserts.
 - 7. Fastener systems.
 - 8. Pipe stands.
 - 9. Pipe-positioning systems.
 - 10. Equipment supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Fiberglass strut systems.

- 4. Pipe stands.
- 5. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of trapeze hangers.
 - 2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
 - 3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe and Tube Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and Ubolts.

2.3 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 - 1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 - 2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 3. Channels: Continuous slotted carbon-steel channel with inturned lips.
 - 4. Channel Width: Selected for applicable load criteria.
 - 5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Non-MFMA Manufacturer Metal Framing Systems:
 - 1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 - 2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 3. Channels: Continuous slotted carbon-steel channel with inturned lips.
 - 4. Channel Width: Select for applicable load criteria.
 - 5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along chaunel.
 - 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.4 THERMAL HANGER-SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psig ASTM C552, Type II cellular glass with 100-psig or

ASTM C591, Type VI, Grade I polyisocyanurate with 125-psig minimum compressive strength.

- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Indoor Applications: Zinc-coated steel.
 - 2. Outdoor Applications: Stainless steel.

2.6 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand:
 - 1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
 - 2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
 - 3. Hardware: Galvanized steel or polycarbonate.
 - 4. Accessories: Protection pads.
- C. Low-Profile, Single-Base, Single-Pipe Stand:
 - 1. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
 - 2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
 - 3. Vertical Members: Two galvanized-steel, continuous-thread, 1/2-inch rods.

- 4. Horizontal Member: Adjustable horizontal, galvanized-steel pipe support channels.
- 5. Pipe Supports: Strut clamps, Clevis hanger, Swivel hanger.
- 6. Hardware: Galvanized steel.
- 7. Accessories: Protection pads.
- 8. Height: 12 inches above roof.
- D. High-Profile, Single-Base, Single-Pipe Stand:
 - 1. Description: Single base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 2. Base: Single vulcanized rubber or molded polypropylene.
 - 3. Vertical Members: Two galvanized-steel, continuous-thread, 1/2-inch rods.
 - 4. Horizontal Member: One adjustable-height, galvanized- or stainless-steel, pipe-support slotted channel or plate.
 - 5. Pipe Supports: Roller, Clevis hanger, Swivel hanger.
 - 6. Hardware: Galvanized OR Stainless steel.
 - 7. Accessories: Protection pads, 1/2-inch, continuous-thread, galvanized-steel rod, 1/2-inch, continuous-thread, stainless-steel rod.
 - 8. Height: 36 inches above roof.
- E. High-Profile, Multiple-Pipe Stand:
 - 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - 2. Bases: Two or more; vulcanized rubber.
 - 3. Vertical Members: Two or more, galvanized or stainless-steel channels.
 - 4. Horizontal Members: One or more, adjustable-height, galvanized or stainless-steel pipe support.
 - 5. Pipe Supports: Roller, Strut clamps, Clevis hanger or Swivel hanger.
 - 6. Hardware: Galvanized or Stainless steel.
 - 7. Accessories: Protection pads, 1/2-inch, continuous-thread rod.
 - 8. Height: 36 inches above roof.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structuralsteel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 PIPE-POSITIONING SYSTEMS

A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbonsteel shapes.

2.9 MATERIALS

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A240/A240M.
- E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.
- F. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Pipe Stand Installation:
 - 1. Pipe Stand Types, except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 7200 "Roof Accessories" for curbs.
- H. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

- K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- L. Install lateral bracing with pipe hangers and supports to prevent swaying.
- M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.
- N. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- P. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal hanger-shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow offcenter closure for hanger installation before pipe erection.
 - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 - Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

- Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
- Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
- Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
- Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
- 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
- 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
- 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steelpipe base stanchion support and cast-iron floor flange or carbon-steel plate.
- 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
- Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
- 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
- Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
- Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
- Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
- Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

- 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
- 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
 - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 6. C-Clamps (MSS Type 23): For structural shapes.
 - 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 - 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 - Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel Ibeams for heavy loads.
 - 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel Ibeams for heavy loads, with link extensions.

- 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
- 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 - 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 - 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 - 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 - 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 - Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

- 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
- 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- R. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - Valve tags.
 - 6. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch, stainless steel, 0.025-inch aluminum, 0.032inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Letter Color: White.

- 3. Background Color: Black.
- 4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- 5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- 6. Fasteners: Stainless-steel rivets or self-tapping screws.
- 7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: Black.
 - 3. Background Color: White.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Red.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.4 STENCILS

- A. Stencils for Piping:
 - 1. Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
 - 2. Stencil Material: Brass.
 - 3. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 4. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link chain or beaded chain or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

- A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches minimum.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Safety yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
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3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- Β. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

- A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- **B**. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - At access doors, manholes, and similar access points that permit view of concealed 4. piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - On piping above removable acoustical ceilings. Omit intermediately spaced labels. 7.
- C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- D. Pipe Label Color Schedule:
 - 1. Low-Pressure Compressed Air Piping:
 - Background: Safety blue. a.
 - Letter Colors: White. b.
 - 2. High-Pressure Compressed Air Piping:
 - Background: Safety blue. a.
 - Letter Colors: White. b.
 - 3. Domestic Water Piping
 - a. Background: Safety green.
 - Letter Colors: White. b.

- 4. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: Safety black.
 - b. Letter Color: White.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Cold Water: 1-1/2 inches, round.
 - b. Hot Water: 1-1/2 inches, round.
 - c. Low-Pressure Compressed Air: 1-1/2 inches, round.
 - d. High-Pressure Compressed Air: 1-1/2 inches, round.
 - 2. Valve-Tag Colors:
 - a. Cold Water: Natural.
 - b. Hot Water: Natural.
 - c. Low-Pressure Compressed Air: Natural.
 - d. High-Pressure Compressed Air: Natural.
 - 3. Letter Colors:
 - a. Cold Water: White.
 - b. Hot Water: White.
 - c. Low-Pressure Compressed Air: White.
 - d. High-Pressure Compressed Air: White.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 0719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Domestic recirculating hot-water piping.
 - 4. Domestic chilled-water piping for drinking fountains.
 - 5. Sanitary waste piping exposed to freezing conditions.
 - 6. Storm-water piping exposed to freezing conditions.
 - 7. Roof drains and rainwater leaders.
 - 8. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Related Sections:
 - 1. Section 22 0716 "Plumbing Equipment Insulation" for equipment insulation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Sustainable Design Submittals.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

- D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
 - 1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
 - 2. Jacket Materials for Pipe: 12 inches long by NPS 2.
 - 3. Sheet Jacket Materials: 12 inches square.
 - 4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less and smoke-developed index of 150 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Comply with ASTM C552.
 - 1. Preformed Pipe Insulation: Type II, Class 1, without jacket.
 - 2. Preformed Pipe Insulation: Type II, Class 2, with factory-applied ASJ jacket.
 - 3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
 - 4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

- G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials.
- H. Mineral-Fiber, Preformed Pipe: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547.
 - 1. Preformed Pipe Insulation: Type I, Grade A, without factory-applied jacket with factoryapplied ASJ.
 - 2. 850 deg F.
 - 3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
 - 4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C195.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
- C. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.
 - 1. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
 - 2. Wet Flash Point: Below 0 deg F.
 - 3. Service Temperature Range: 40 to 200 deg F.
 - 4. Color: Black.
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- E. Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
- F. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
- G. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

- B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 - 2. Service Temperature Range: 0 to plus 180 deg F.
 - 3. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD Qualified Products Database.
 - 4. Color: White.
- C. Vapor-Retarder Mastic, Solvent Based, Indoor Use: Suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 - 2. Service Temperature Range: 0 to 180 deg F.
 - 3. Color: White.
- D. Vapor-Retarder Mastic, Solvent Based, Outdoor Use: Suitable for outdoor use on belowambient services.
 - 1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 - 2. Service Temperature Range: Minus 50 to plus 220 deg F.
 - 3. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.
 - 2. Service Temperature Range: 0 to plus 180 deg F.
 - 3. Color: White.

2.5 LAGGING ADHESIVES

- A. Adhesives shall comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
 - 1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fireresistant lagging cloths over pipe insulation.
 - 2. Service Temperature Range: 20 to plus 180 deg F.
 - 3. Color: White.

2.6 SEALANTS

- A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.
- B. Joint Sealants:
 - 1. Permanently flexible, elastomeric sealant.
 - 2. Service Temperature Range: Minus 58 to plus 176 deg F.
 - 3. Color: White or gray.

- C. FSK and Metal Jacket Flashing Sealants:
 - 1. Fire- and water-resistant, flexible, elastomeric sealant.
 - 2. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 3. Color: Aluminum.
- D. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
 - 1. Fire- and water-resistant, flexible, elastomeric sealant.
 - 2. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 3. Color: White.

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
 - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.
- B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.10 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

- 1. Adhesive: As recommended by jacket material manufacturer.
- 2. Color: Color-code jackets based on system. Color as selected by Architect.
- 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- D. Metal Jacket:
 - 1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
 - 2. Stainless-Steel Jacket: ASTM A240/A240M.
 - a. Factory cut and rolled to size.
 - b. Material, finish, and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.

- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- E. Underground Direct-Buried Jacket: 125-mil-thick vapor barrier and waterproofing membrane, consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
- F. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with white aluminum-foil facing.

2.11 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 11.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 6.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 - 1. Width: 2 inches.
 - 2. Thickness: 6 mils.
 - 3. Adhesion: 64 ounces force/inch in width.
 - 4. Elongation: 500 percent.
 - 5. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Width: 2 inches,
 - 2. Thickness: 3.7 mils.
 - 3. Adhesion: 100 ounces force/inch in width.
 - 4. Elongation: 5 percent.

5. Tensile Strength: 34 lbf/inch in width.

2.12 SECUREMENTS

- A. Bands:
 - 1. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
 - 2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.

2.13 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers,:
 - 1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and coldwater supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective Shielding Piping Enclosures,:
 - 1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and coldwater supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

- B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range of between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - 2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.

- 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
 - Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.

- 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
- 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
- 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

- 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
- 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
- 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
- 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
- 6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
- 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- 8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
 - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe

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insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.

- Construct removable valve insulation covers in same manner as for flanges, except divide 3. the two-part section on the vertical center line of valve body.
- When covers are made from block insulation, make two halves, each consisting of 4. mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with the wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
- Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed 5. surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

- Insulation Installation on Straight Pipes and Tubes: A.
 - 1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
 - 4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.
- Β. Insulation Installation on Pipe Flanges:
 - 1. Install preformed pipe insulation to outer diameter of pipe flange.
 - Make width of insulation section same as overall width of flange and bolts, plus twice the 2. thickness of pipe insulation.
 - Fill voids between inner circumference of flange insulation and outer circumference of 3. adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation.
 - Install jacket material with manufacturer's recommended adhesive, overlap seams at least 4. 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 - When preformed sections of insulation are not available, install mitered sections of 2. cellular-glass insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed sections of cellular-glass insulation to valve body.

- 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
- 3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed valve covers manufactured of same material as that of pipe insulation when available.
 - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.

- 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
 - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
 - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 4. Install insulation to flanges as specified for flange insulation application.

3.9 INSTALLATION OF PHENOLIC INSULATION

- A. General Installation Requirements:
 - 1. Secure single-layer insulation with stainless steel bands at 12-inch intervals, and tighten bands without deforming insulation materials.
 - 2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless steel bands at 12-inch intervals.
- B. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

- 3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
- 4. For insulation with factory-applied jackets with vapor retarders on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.
- C. Insulation Installation on Pipe Flanges:
 - 1. Install preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as that of pipe insulation.
- D. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.
- E. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.
 - 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.

3.10 INSTALLATION OF POLYOLEFIN INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as that of pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:

- 1. Install mitered sections of polyolefin pipe insulation.
- 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
 - 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.11 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 - 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 - 2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
 - 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.12 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 9113 "Exterior Painting." and Section 09 9123 "Interior Painting."

- 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless steel jackets.

3.13 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
- E. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- F. All insulation applications will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports.

3.14 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.15 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - NPS 1 and Smaller: Insulation shall be one of the following:
 a. Flexible Elastomeric: 3/4 inch thick.
 - 2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
 - 1. NPS 1-1/4 and Smaller: Insulation shall be the following:
 - a. Flexible Elastomeric: 3/4 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- C. Stormwater and Overflow:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- D. Roof Drain and Overflow Drain Bodies:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1/2 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
- F. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 3/4 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
- G. Hot Service Drains:
 - 1. All Pipe Sizes: Insulation shall be one of the following:

- a. Cellular Glass: 1-1/2 inches thick.
- b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- H. Hot Service Vents:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.16 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

- A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches thick.
- B. Chilled Water, All Sizes: Cellular glass, 2 inches thick.

3.17 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. PVC: 20 mils thick.
 - 2. Aluminum, Smooth: 0.020 inch thick.
 - 3. Painted Aluminum, Smooth: 0.020 inch thick.
 - 4. Stainless Steel, Type 304 or Type 316, Smooth No. 2B Finish: 0.020 inch thick.
- D. Piping, Exposed:
 - 1. PVC: 20 mils thick.
 - 2. Aluminum, Smooth: 0.020 inch thick.
 - 3. Painted Aluminum, Smooth: 0.020 inch thick.
 - 4. Stainless Steel, Type 304 or Type 316, Smooth No. 2B Finish: 0.016 inch thick.

3.18 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. PVC: 20 mils thick.
 - 2. Aluminum, Smooth: 0.020 inch thick.
 - 3. Painted Aluminum, Smooth: 0.020 inch thick.

- 4. Stainless Steel, Type 304 or Type 316, Smooth No. 2B Finish: 0.016 inch thick.
- D. Piping, Exposed:
 - 1. PVC: 30 mils thick.
 - 2. Painted Aluminum, Smooth with Z-Shaped Locking Seam: 0.020 inch thick.
 - 3. Stainless Steel, Type 304 or Type 316, Smooth No. 2B Finish with Z-Shaped Locking Seam: 0.016 inch thick.

3.19 UNDERGROUND, FIELD-APPLIED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION

SECTION 22 1116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Copper tube and fittings.
 - 2. Ductile-iron pipe and fittings.
 - 3. Galvanized-steel pipe and fittings.
 - 4. Stainless steel piping and fittings.
 - 5. CPVC piping.
 - 6. PEX tube and fittings.
 - 7. PEX-AL-PEX tube and fittings.
 - 8. PEX-AL-HDPE tube and fittings.
 - 9. PVC pipe and fittings.
 - 10. PP-R pipe and fittings.
 - 11. Piping joining materials.
 - 12. Encasement for piping.
 - 13. Transition fittings.
 - 14. Dielectric fittings.
- B. Related Requirements:
 - 1. Section 22 1113 "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Pipe and tube.
 - 2. Fittings.
 - 3. Joining materials.
 - 4. Transition fittings.
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.

- 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
- 3. Environmental Product Declaration: For each product.
- 4. Health Product Declaration: For each product.
- 5. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. System purging and disinfecting activities report.
- C. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of water service.
 - 2. Do not interrupt water service without Architect's written permission.

1.6 WARRANTY

- A. Polypropylene Piping (PP-R) Manufacturer's Warranty: Manufacturer agrees to repair or replace PP-R pipe and fittings that fail in materials or workmanship within 10 years from date of Substantial Completion.
 - 1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.
 - Warranty is to be in effect only upon submission by the Contractor to the manufacturer of valid pressure/leak documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tube: ASTM B88, Type K.
- B. Annealed-Temper Copper Tube: ASTM B88, Type K and ASTM B88, Type M.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-andsocket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- G. Wrought Copper Unions: ASME B16.22.
- H. Copper-Tube, Mechanically Formed Tee Fitting: For forming T-branch on copper water tube.
 - 1. Description: Tee formed in copper tube in accordance with ASTM F2014.
- I. Grooved, Mechanical-Joint, Copper Tube Appurtenances:
 - 1. Grooved-End, Copper Fittings: ASTM B75 copper tube or ASTM B584 bronze castings.
 - 2. Grooved-End-Tube Couplings: To fit copper-tube dimensions; rigid pattern unless otherwise indicated; gasketed fitting, EPDM-rubber gasket, UL classified per NSF 61 and NSF 372, and rated for minimum 180 deg F, for use with ferrous housing and steel bolts and nuts; 300 psigminimum CWP pressure rating.
- J. Copper Tube, Pressure-Seal-Joint Fittings:
 - 1. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.
 - 2. Minimum 200-psig working-pressure rating at 250 deg F.
- K. Copper-Tube, Push-on-Joint Fittings:
 - 1. Description:
 - Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
 - Stainless steel teeth and EPDM-rubber, O-ring seal in each end instead of solderjoint ends.

2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe:
 - AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

- Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Standard-Pattern, Mechanical-Joint Fittings:
 - 1. AWWA C110/A21.10, ductile or gray iron.
 - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- C. Compact-Pattern, Mechanical-Joint Fittings:
 - 1. AWWA C153/A21.53, ductile iron.
 - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- D. Push-on-Joint, Ductile-Iron Pipe:
 - 1. AWWA C151/A21.51.
 - 2. Push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
- E. Standard-Pattern, Push-on-Joint Fittings:
 - 1. AWWA C110/A21.10, ductile or gray iron.
 - 2. Gaskets: AWWA C111/A21.11, rubber.
- F. Compact-Pattern, Push-on-Joint Fittings:
 - 1. AWWA C153/A21.53, ductile iron.
 - 2. Gaskets: AWWA C111/A21.11, rubber.
- G. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.
- H. Appurtenances for Grooved-End, Ductile-Iron Pipe:
 - 1. Fittings for Grooved-End, Ductile-Iron Pipe: ASTM A47/A47M, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions that match pipe.
 - 2. Mechanical Couplings for Grooved-End, Ductile-Iron-Piping:
 - a. AWWA C606 for ductile-iron-pipe dimensions.
 - b. Ferrous housing sections.
 - c. EPDM-rubber gaskets suitable for hot and cold water.
 - d. Bolts and nuts.
 - e. Minimum Pressure Rating:
 - 1) NPS 14 to NPS 18: 250 psig.
 - 2) NPS 20 to NPS 46: 150 psig.

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe:

Northport FMS #9 Renovations Northport, AL

- 1. ASTM A53/A53M, Type E,, Standard Weight.
- 2. Include ends matching joining method.
- B. Galvanized-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106/A106M, Standard Weight, seamless steel pipe with threaded ends.
- C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- D. Malleable-Iron Unions:
 - 1. ASME B16.39, Class 150.
 - 2. Hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal, bronze seating surface.
 - 4. Threaded ends.
- E. Flanges: ASME B16.1, Class 125, cast iron.
- F. Appurtenances for Grooved-End, Galvanized-Steel Pipe:
 - 1. ASTM Fittings for Grooved-End, Galvanized-Steel Pipe: Galvanized, ASTM A47/A47M, malleable-iron casting; ASTM A106/A106M, steel pipe; or ASTM A536, ductile-iron casting; with dimensions matching steel pipe.
 - 2. AWWA Fittings for Grooved-End, Galvanized-Steel Pipe:
 - a. AWWA C606 for steel-pipe dimensions.
 - b. Ferrous housing sections.
 - c. EPDM-rubber gaskets suitable for hot and cold water.
 - d. Bolts and nuts.
 - e. Minimum Pressure Rating:
 - 1) NPS 8 and Smaller: 600 psig.

2.5 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B32, lead-free alloys.
- D. Flux: ASTM B813, water flushable.
- E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for generalduty brazing unless otherwise indicated.
- F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F493.

- 1. Verify solvent cement has a VOC content of 490 g/L or less.
- 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- G. Solvent Cements for Joining PVC Piping: ASTM D2564. Include primer according to ASTM F656.
 - 1. Verify solvent cement has a VOC content of 510 g/L or less.
 - 2. <Double click to insert sustainable design text for adhesive primer.>
 - 3. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 4. Verify adhesive primer complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.6 ENCASEMENT FOR PIPING

- A. Standard: ASTM A674 or AWWA C105/A21.5.
- B. Form: Sheet or tube.
- C. Color: Black or natural.

2.7 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
- D. Plastic-to-Metal Transition Fittings:
 - 1. Description:
 - a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.

- b. One end with threaded brass insert and one solvent-cement-socket or threaded end.
- E. Plastic-to-Metal Transition Unions:
 - 1. Description:
 - a. CPVC or PVC four-part union.
 - b. Brass or stainless steel threaded end.
 - c. Solvent-cement-joint or threaded plastic end.
 - d. Rubber O-ring.
 - e. Union nut.

2.8 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Standard: ASSE 1079.
 - 2. Pressure Rating: 150 psig.
 - 3. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Standard: ASSE 1079.
 - 2. Factory-fabricated, bolted, companion-flange assembly.
 - 3. Pressure Rating: 150 psig.
 - 4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
 - 1. Nonconducting materials for field assembly of companion flanges.
 - 2. Pressure Rating: 150 psig.
 - 3. Gasket: Neoprene or phenolic.
 - 4. Bolt Sleeves: Phenolic or polyethylene.
 - 5. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
 - 1. Standard: IAPMO PS 66.
 - 2. Electroplated steel nipple complying with ASTM F1545.
 - 3. Pressure Rating and Temperature: 300 psig at 225 deg F.
 - 4. End Connections: Male threaded or grooved.
 - 5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be one of the following:
 - 1. Annealed-temper copper tube, ASTM B88, Type K; joints.
- E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:
 - 1. Annealed-temper copper tube, ASTM B88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
 - Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
- F. Under-building-slab, combined domestic water, building-service, and fire-service-main piping, NPS 6 to NPS 12, shall be one of the following:
 - 1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
- G. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. Drawn-temper or annealed-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed copper pressure-seal-joint fittings; and pressure-sealed joints.
- H. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - 2. Drawn-temper copper tube, ASTM B88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed or soldered joints.
 - 3. Drawn-temper copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
 - Drawn-temper copper tube, ASTM B88, Type L; copper push-on-joint fittings; and pushon joints.
- I. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:

- 1. Drawn-temper copper tube, ASTM B88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed or soldered joints.
- Drawn-temper copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
- 3. Drawn-temper copper tube, ASTM B88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.
- 4. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
- 5. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
- J. Aboveground, combined domestic water-service and fire-service-main piping, NPS 6 to NPS 12, shall be one of the following:
 - 1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
 - 2. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - 3. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

3.2 EARTHWORK

A. Comply with requirements in Section 31 2000 "Earth Moving" for excavating, trenching, and backfilling.

3.3 INSTALLATION OF PIPING

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A674 or AWWA C105/A21.5.
- E. Install valves according to the following:
 - 1. Section 22 0523.12 "Ball Valves for Plumbing Piping."
 - 2. Section 22 0523.13 "Butterfly Valves for Plumbing Piping."
 - 3. Section 22 0523.14 "Check Valves for Plumbing Piping."
 - 4. Section 22 0523.15 "Gate Valves for Plumbing Piping."
- F. Install domestic water piping level without pitch and plumb.

- G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 22 0548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install PEX tubing with loop at each change of direction of more than 90 degrees.
- Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- R. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 22 0519 "Meters and Gages for Plumbing Piping."
- S. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 22 1123 "Domestic Water Pumps."
- T. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 22 0519 "Meters and Gages for Plumbing Piping."
- U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."
- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 0518 "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.
- G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
- H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- J. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- K. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Square cut groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

- L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- M. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
 - 3. PVC Piping: Join according to ASTM D2855.
- N. Joints for PEX Tubing, ASTM: Join according to ASTM F1807 for metal insert and copper crimp ring fittings and ASTM F1960 for cold expansion fittings and reinforcing rings.
- O. Joints for PEX Tubing, ASSE: Join according to ASSE 1061 for push-fit fittings.
- P. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.5 INSTALLATION OF TRANSITION FITTINGS

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.6 INSTALLATION OF DIELECTRIC FITTINGS

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.7 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 22 0548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for hangers, supports, and anchor devices in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."
- C. Install hangers for copper, ductile iron, galvanized steel, and stainless steel tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Support horizontal piping within 12 inches of each fitting.
- E. Support vertical runs of copper, ductile iron, galvanized steel, and stainless steel tubing and piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.8 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 - 4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.9 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.10 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

- a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
- b. Adjust calibrated balancing valves to flows indicated.
- 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
- 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
- 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
- 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.

- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.12 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of watersample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

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SECTION 22 1119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Water pressure-reducing valves.
 - 4. Automatic water shutoff valve systems.
 - 5. Balancing valves.
 - 6. Temperature-actuated, water mixing valves.
 - 7. Strainers for domestic water piping.
 - 8. Outlet boxes.
 - 9. Hose stations.
 - 10. Hose bibbs.
 - Wall hydrants.
 - 12. Ground hydrants.
 - 13. Post hydrants.
 - 14. Roof hydrants.
 - 15. Drain valves.
 - 16. Water-hammer arresters.
 - 17. Trap-seal primer device.
 - 18. Trap-seal primer systems.
 - 19. Flexible connectors.
 - 20. Water meters.
- B. Related Requirements:
 - 1. Section 21 1100 "Facility Fire-Suppression Water-Service Piping" for fire water-service backflow prevention devices.
 - 2. Section 22 0519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.
 - 3. Section 22 1116 "Domestic Water Piping" for water meters.
 - 4. Section 22 3200 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
 - 5. Section 22 4300 "Healthcare Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.

- 6. Section 22 4500 "Emergency Plumbing Fixtures" for water tempering equipment.
- 7. Section 22 4716 "Pressure Water Coolers" for water filters for water coolers.
- 8. Section 22 4723 "Remote Water Coolers" for water filters for water coolers.
- 9. Section 23 0923.18 "Leak Detection Instruments" for leak detection devices related to HVAC applications.

1.3 DEFINITIONS

- A. AMI: Advanced Metering Infrastructure.
- B. AMR: Automatic Meter Reading.
- C. FKM: A family of fluroelastomer materials defined by ASTM D1418.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.
 - 1. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Test and inspection reports.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Standard: ASSE 1001.
 - 2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 3. Body: Bronze.
 - 4. Inlet and Outlet Connections: Threaded.
 - 5. Finish: Rough bronze or Chrome plated.
- B. Hose-Connection Vacuum Breakers:
 - 1. Standard: ASSE 1011.
 - 2. Body: Bronze, nonremovable, with manual drain.
 - 3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 - 4. Finish: Chrome or nickel plated.
- C. Pressure Vacuum Breakers:
 - 1. Standard: ASSE 1020.
 - 2. Operation: Continuous-pressure applications.
 - 3. Pressure Loss: 5 psig maximum, through middle third of flow range.

2.4 BACKFLOW PREVENTERS

- A. Intermediate Atmospheric-Vent Backflow Preventers:
 - 1. Standard: ASSE 1012.
 - 2. Operation: Continuous-pressure applications.
 - 3. Size: NPS 1/2.
 - 4. Body: Bronze.
 - 5. End Connections: Union, solder joint.
 - 6. Finish: Rough bronze.

B. Reduced-Pressure-Principle Backflow Preventers:

- 1. Standard: ASSE 1013.
- 2. Operation: Continuous-pressure applications.
- 3. Pressure Loss: 8 psig maximum, through middle third of flow range.
- 4. Accessories:

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- a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
- b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

- c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
- C. Double-Check, Backflow-Prevention Assemblies:
 - 1. Standard: ASSE 1015.
 - 2. Operation: Continuous-pressure applications unless otherwise indicated.
 - 3. Pressure Loss: 5 psig maximum, through middle third of flow range.
- D. Dual-Check-Valve Backflow Preventers:
 - 1. Standard: ASSE 1024.
 - 2. Operation: Continuous-pressure applications.
- E. Hose-Connection Backflow Preventers:
 - 1. Standard: ASSE 1052.
 - 2. Operation: Up to 10-foot head of water back pressure.
 - 3. Inlet Size: NPS 3/4.
 - 4. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
 - 5. Capacity: At least 3-gpm flow.
- F. Backflow-Preventer Test Kits:
 - 1. Description: Factory calibrated, with gauges, fittings, hoses, and carrying case with testprocedure instructions.

2.5 WATER PRESSURE-REDUCING VALVES

- A. Water Regulators Insert drawing designation if any:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.
 - b. Cash Acme, A Division of Reliance Worldwide Corporation.
 - c. WATTS.
 - d. Zurn Industries, LLC.
 - 2. Standard: ASSE 1003.
 - 3. Pressure Rating: Initial working pressure of 150 psig.
 - 4. Body: Bronze for NPS 2 and smaller; bronze or cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
 - 5. Valves for Booster Heater Water Supply: Include integral bypass.
 - End Connections: Threaded or solder for NPS 2 and smaller; flanged or solder for NPS 2-1/2 and NPS 3.
- B. Water-Control Valves:
 - 1. Description: Pilot-operated, diaphragm-type, single-seated, main water-control valve.

- Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
- 3. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless steel body.
 - a. Pattern: Angle or Globe-valve design.
 - b. Trim: Stainless steel.
- 4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.6 BALANCING VALVES

- A. Copper-Alloy Calibrated Balancing Valves:
 - 1. Type: Ball valve with two readout ports and memory-setting indicator.
 - 2. Body: Brass or bronze.
 - 3. Size: Same as connected piping, but not larger than NPS 2.
 - 4. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.
- B. Automatic Flow Control Balancing Valves:
 - 1. Flow Regulation: Plus or minus 5 percent over 95 percent of the working range.
 - 2. Pressure Rating: 200 psig.
 - 3. Size: NPS 2 or smaller.
 - 4. Body: Stainless steel or brass.
 - 5. Flow Cartridge: Stainless steel or antiscale polymer.
 - 6. End Connections: Threaded or solder joint.

2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES

- A. Water-Temperature Limiting Devices:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company; a Division of Morris Group International.
 - b. Apollo Flow Controls; Conbraco Industries, Inc.
 - c. Cash Acme, A Division of Reliance Worldwide Corporation.
 - d. Leonard Valve Company.
 - e. POWERS; A WATTS Brand.
 - f. Symmons Industries, Inc.
 - g. TACO Comfort Solutions, Inc.
 - h. WATTS.
 - i. Zurn Industries, LLC.
 - 2. Standard: ASSE 1070.
 - 3. Pressure Rating: 125 psig.
 - 4. Type: Thermostatically controlled, water mixing valve.
 - 5. Material: Bronze body with corrosion-resistant interior components.

- 6. Connections: Threaded union inlets and outlet.
- 7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperaturecontrol handle.
- 8. Tempered-Water Setting: 110 deg F.
- 9. Valve Finish: Chrome plated.
- B. Individual-Fixture, Water Tempering Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lawler Manufacturing Company, Inc.
 - b. POWERS; A WATTS Brand.
 - c. Zurn Industries, LLC.
 - 2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
 - 3. Pressure Rating: 125 psig minimum unless otherwise indicated.
 - 4. Material: Bronze body with corrosion-resistant interior components.
 - 5. Temperature Control: Adjustable.
 - 6. Connections: Threaded inlets and outlet.
 - 7. Finish: Chrome plated.
 - 8. Tempered-Water Setting: 110 deg-F.

2.8 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers:
 - 1. Pressure Rating: 125 psig minimum unless otherwise indicated.
 - 2. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and larger.
 - 3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 - 4. Screen: Stainless steel with round perforations unless otherwise indicated.
 - 5. Drain: Pipe plug.

2.9 OUTLET BOXES

- A. Clothes Washer Outlet Boxes:
 - 1. Mounting: Recessed. Fire rated.
 - 2. Material and Finish: Enameled-steel or epoxy-painted-steel, Enameled-steel, epoxypainted-steel, or plastic, Plastic, Stainless steel box and faceplate.
 - 3. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
 - 4. Drain Outlet Connection: NPS 1-1/2.
 - 5. Accessory: Water hammer arresters.
 - 6. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
 - 7. Drain: NPS 1-1/2 standpipe and P-trap for direct waste connection to drainage piping.

- 8. Inlet Hoses: Two 60-inch-long, rubber, household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
- 9. Drain Hose: One 48-inch-long, rubber, household clothes washer drain hose with hooked end.
- B. Icemaker Outlet Boxes:
 - 1. Mounting: Recessed.
 - 2. Material and Finish: Enameled-steel or epoxy-painted-steel, Enameled-steel, epoxypainted-steel, or plastic, Plastic, Stainless steel box and faceplate.
 - 3. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
 - 4. Accessory: Water hammer arrestor.
 - 5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.10 HOSE BIBBS

- A. Hose Bibbs:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. MIFAB, Inc.
 - c. Prier Products, Inc.
 - d. WATTS.
 - e. Woodford Manufacturing Company.
 - f. Zurn Industries, LLC.
 - 2. Standard: ASME A112.18.1 for sediment faucets.
 - 3. Body Material: Bronze.
 - 4. Seat: Bronze, replaceable.
 - 5. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
 - 6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
 - 7. Pressure Rating: 125 psig.
 - 8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
 - 9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
 - 10. Finish for Service Areas: Rough bronze.
 - 11. Finish for Finished Rooms: Chrome or nickel plated.
 - 12. Operation for Equipment Rooms: Wheel handle or operating key.
 - 13. Operation for Service Areas: Operating key.
 - 14. Operation for Finished Rooms: Wheel handle.
 - 15. Include operating key with each operating-key hose bibb.
 - 16. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.11 WALL HYDRANTS

- A. Nonfreeze Wall Hydrants:
 - 1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
 - 2. Pressure Rating: 125 psig.
 - 3. Operation: Loose key.
 - 4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
 - 5. Inlet: NPS 3/4 or NPS 1.
 - 6. Outlet, Concealed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
 - 7. Box: Deep, flush mounted with cover.
 - 8. Box and Cover Finish: Polished nickel bronze.
 - 9. Nozzle and Wall-Plate Finish: Polished nickel bronze.
 - 10. Operating Keys(s): Two with each wall hydrant.
- B. Nonfreeze, Hot- and Cold-Water Wall Hydrants Insert drawing designation if any:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Prier Products, Inc.
 - e. WATTS.
 - f. Woodford Manufacturing Company.
 - g. Zurn Industries, LLC.
 - 2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
 - 3. Pressure Rating: 125 psig.
 - 4. Operation: Loose key.
 - 5. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
 - 6. Inlet: NPS 3/4 or NPS 1.
 - 7. Outlet: Concealed.
 - 8. Box: Deep, flush mounted with cover.
 - 9. Box and Cover Finish: Polished nickel bronze.
 - 10. Vacuum Breaker:
 - a. Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
 - b. Garden-hose thread complying with ASME B1.20.7 on outlet.
 - 11. Operating Key(s): Two with each wall hydrant.
- C. Nonfreeze Vacuum Breaker Wall Hydrants:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Prier Products, Inc.
 - c. WATTS.
 - d. Woodford Manufacturing Company.
 - e. Zurn Industries, LLC.
- 2. Standard: ASSE 1019, Type A or Type B.
- 3. Type: Automatic draining with integral air-inlet valve.
- 4. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
- 5. Pressure Rating: 125 psig.
- 6. Operation: Loose key or wheel handle.
- 7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
- 8. Inlet: NPS 1/2 or NPS 3/4.
- 9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.12 GROUND HYDRANTS

- A. Nonfreeze Ground Hydrants:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Prier Products, Inc.
 - e. WATTS.
 - f. Woodford Manufacturing Company.
 - g. Zurn Industries, LLC.
 - 2. Standard: ASME A112.21.3M.
 - 3. Type: Nonfreeze, concealed-outlet ground hydrant with box.
 - 4. Operation: Loose key.
 - 5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
 - 6. Inlet: NPS 3/4.
 - 7. Outlet: Garden-hose thread complying with ASME B1.20.7.
 - 8. Drain: Designed with hole to drain into ground when shut off.
 - 9. Box: Standard pattern with cover.
 - 10. Box and Cover Finish: Rough bronze.
 - 11. Operating Key(s): Two with each ground hydrant.
 - 12. Vacuum Breaker: ASSE 1011.

2.13 POST HYDRANTS

- A. Nonfreeze, Draining-Type Post Hydrants:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. MIFAB, Inc.
 - c. WATTS.
 - d. Woodford Manufacturing Company.
 - e. Zurn Industries, LLC.
 - 2. Standard: ASME A112.21.3M.
 - 3. Type: Nonfreeze, exposed-outlet post hydrant.
 - 4. Operation: Loose key.
 - 5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
 - 6. Casing: Bronze with casing guard.
 - 7. Inlet: NPS 3/4.
 - 8. Outlet: Garden-hose thread complying with ASME B1.20.7.
 - 9. Drain: Designed with hole to drain into ground when shut off.
 - 10. Vacuum Breaker:
 - a. Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
 - b. Garden-hose thread complying with ASME B1.20.7 on outlet.
 - 11. Operating Key(s): Two with each loose-key-operation wall hydrant.

2.14 WATER-HAMMER ARRESTERS

- A. Water-Hammer Arresters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Jay R. Smith Mfg Co; a division of Morris Group International.
 - c. Josam Company.
 - d. MIFAB, Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. WATTS.
 - g. Zurn Industries, LLC.
 - 2. Standard: ASSE 1010 or PDI-WH 201.
 - 3. Type: Metal bellows or Piston.
 - 4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.15 TRAP-SEAL PRIMER DEVICE

- A. Supply-Type, Trap-Seal Primer Device:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Sioux Chief Manufacturing Company, Inc.
 - e. WATTS.
 - f. Zurn Industries, LLC.
 - 2. Standard: ASSE 1018.
 - 3. Pressure Rating: 125 psig minimum.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
 - 6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
 - 7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.
- B. Drainage-Type, Trap-Seal Primer Device:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. MIFAB, Inc.
 - c. Precision Plumbing Products.
 - d. Zurn Industries, LLC.
 - 2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
 - 3. Size: NPS 1-1/4 minimum.
 - 4. Material: Chrome-plated, cast brass.

2.16 FLEXIBLE CONNECTORS

- A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
- B. Stainless Steel-Hose Flexible Connectors: Corrugated-stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.

3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.17 WATER METERS

- A. Displacement-Type Water Meters:
 - 1. Standard: AWWA C700.
 - 2. Pressure Rating: 150-psig working pressure.
 - 3. Body Design: Nutating disc; totalization meter.
 - 4. Registration: In gallons or cubic feet as required by utility company.
 - a. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.
 - 1) System shall be capable of transmitting data using AMR/AMI technology.
 - 5. Case: Bronze.
 - 6. End Connections: Threaded or flanged.
- B. Turbine-Type Water Meters:
 - 1. Standard: AWWA C701.
 - 2. Pressure Rating: 150 psig working pressure.
 - 3. Body Design: Turbine; totalization meter.
 - 4. Registration: In gallons or cubic feet as required by utility company.
 - a. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.
 - 1) System shall be capable of transmitting data using AMR/AMI technology.
 - 5. Case: Bronze.
 - 6. End Connections: Threaded or flanged.
- C. Compound-Type Water Meters:
 - 1. Standard: AWWA C702.
 - 2. Pressure Rating: 150-psig working pressure.
 - 3. Body Design: With integral mainline and bypass meters; totalization meter.
 - 4. Registration: In gallons or cubic feet as required by utility company.
 - a. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.
 - 1) System shall be capable of transmitting data using AMR/AMI technology.
 - 5. Case: Bronze.

- 6. End Connections: Flanged.
- D. Ultrasonic-Type Water Meters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Badger Meter, Inc.
 - b. Master Meter, Inc.
 - c. Neptune Technology Group Inc.
 - 2. Standard: Applicable portions of AWWA C700.
 - 3. Pressure Rating: 150 psig working pressure.
 - 4. Body Design: Ultrasonic open flow tube; totalization meter.
 - 5. Registration: In gallons or cubic feet as required by utility company.
 - a. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.
 - 1) System shall be capable of transmitting data using AMR/AMI technology.
 - 6. Case: Bronze.
 - 7. End Connections: Threaded or flanged.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

- A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- B. Water Regulators: Install with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gauges on inlet and outlet.
- C. Water Control Valves: Install with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gauges on inlet and outlet.
- D. Automatic Water Shutoff Valves: Test for signal strength before valve installation. Install automatic shutoff valve downstream from main domestic water shutoff valve. Install valve controller in an accessible location with sensors in areas where water is likely to accumulate.

- E. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.
- F. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- G. Y-Pattern Strainers: For water, install on supply side of each control valve] water pressurereducing valve, solenoid valve, and pump.
- H. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install 1-1/2-by-3-1/2inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 06 1000 "Rough Carpentry."
- I. Hose Stations: Install with check stops or shutoff valves on inlets and with thermometer on outlet.
 - 1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 1-1/2-by-3-1/2-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 06 1000 "Rough Carpentry."
- J. Ground Hydrants: Install with 1 cu. yd. of crushed gravel around drain hole. Set ground hydrants with box flush with grade.
- K. Nonfreeze, Draining-Type Post Hydrants: Install with 1 cu. yd. of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.
- L. Nonfreeze, Nondraining-Type Post Hydrants: Set in concrete or pavement.
- M. Nonfreeze, Sanitary Yard Hydrants: Set with riser pipe in concrete or pavement. Do not encase canister in concrete.
- N. Nonfreeze, Draining-Type Roof Hydrants: Install with drain connection piped to nearest floor drain or to the exterior.
- O. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.
- P. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust value for proper flow.
- Q. Drainage-Type, Trap-Seal Primer Device: Install as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
- R. Trap-Seal Primer Systems: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 PIPING CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 26 0526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.4 CONTROL CONNECTIONS

A. Connect control wiring in accordance with Section 26 0523 "Control-Voltage Electrical Power Cables."

3.5 IDENTIFICATION

- A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Water pressure-reducing valves.
 - 4. Automatic water shutoff valve systems.
 - 5. Balancing valves.
 - 6. Temperature-actuated, water mixing valves.
 - 7. Outlet boxes.
 - 8. Hose stations.
 - 9. Wall hydrants.
 - 10. Ground hydrants.
 - 11. Post hydrants.
 - 12. Roof hydrants.
 - 13. Trap-seal primer device.
 - 14. Trap-seal primer systems.
 - 15. Water meters.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.6 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.
- D. Adjust each pressure vacuum breaker, reduced-pressure-principle backflow preventer, doublecheck, backflow-prevention assembly and double-check, detector-assembly backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections.
 - 1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
 - Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION

SECTION 22 1123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Manual gas shutoff valves.
 - 5. Motorized gas valves.
 - 6. Pressure regulators.
 - 7. Service meters.
 - 8. Dielectric fittings.

1.3 DEFINITIONS

- A. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Piping specialties.
 - 2. Corrugated, stainless-steel tubing with associated components.
 - 3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 4. Pressure regulators. Indicate pressure ratings and capacities.
 - Service meters. Indicate pressure ratings and capacities. Include bypass fittings and meter bars supports.

- 6. Dielectric fittings.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
 - 1. Shop Drawing Scale: 1/4 inch per foot.
 - 2. Detail mounting, supports, and valve arrangements for pressure regulator assembly.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.
- B. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.
- C. Qualification Data: For qualified professional engineer.
- D. Welding certificates.
- E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

1.9 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of natural-gas service.
 - 2. Do not proceed with interruption of natural-gas service without Owner's written permission.

1.10 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 08 3113 "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 - 2. Service Regulators: 100 psig minimum unless otherwise indicated.
 - 3. Minimum Operating Pressure of Service Meter: 65 psig.
- B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.

2.2 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - Wrought-Steel Welding Fittings: ASTM A234/A234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
 - 5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
 - 6. Mechanical Couplings:
 - a. Stainless-steel flanges and tube with epoxy finish.
 - b. Buna-nitrile seals.
 - c. Stainless-steel bolts, washers, and nuts.
 - d. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.
- B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
 - 1. Tubing: ASTM A240/A240M, corrugated, Series 300 stainless steel.
 - 2. Coating: PE with flame retardant.
 - a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 50 or less.
 - 3. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.

- 4. Striker Plates: Steel, designed to protect tubing from penetrations.
- Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
- 6. Operating-Pressure Rating: 5 psig.
- C. Drawn-Temper Copper Tube: Comply with ASTM B88, Type K.
 - 1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
 - 2. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.
 - a. Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - b. Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.
 - 3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.
- D. Annealed-Temper Copper Tube: Comply with ASTM B88, Type K.
 - 1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
 - 2. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - a. Copper fittings with long nuts.
 - b. Metal-to-metal compression seal without gasket.
 - c. Dryseal threads complying with ASME B1.20.3.
 - 3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.
- E. Tin-Lined Copper Tube: ASTM B280, seamless, annealed, with interior tin-plated lining.
 - 1. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - a. Copper fittings with long nuts.
 - b. Metal-to-metal compression seal without gasket.
 - c. Dryseal threads complying with ASME B1.20.3.
- F. PE Pipe: ASTM D2513, SDR 11.
 - 1. PE Fittings: ASTM D2683, socket-fusion type or ASTM D3261, butt-fusion type with dimensions matching PE pipe.
 - 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D2513, SDR 11; and steel pipe complying with ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
 - 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet.
 - b. Casing: Steel pipe complying with ASTM A53/A53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.

- c. Aboveground Portion: PE transition fitting.
- d. Outlet shall be threaded or flanged or suitable for welded connection.
- e. Tracer wire connection.
- f. Ultraviolet shield.
- g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
- 4. Transition Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet connected to steel pipe complying with ASTM A53/A53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - b. Outlet shall be threaded or flanged or suitable for welded connection.
 - c. Bridging sleeve over mechanical coupling.
 - d. Factory-connected anode.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
- Plastic Mechanical Couplings, NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.
 - a. PE body with molded-in, stainless-steel support ring.
 - b. Buna-nitrile seals.
 - c. Acetal collets.
 - d. Electro-zinc-plated steel stiffener.
- 6. Plastic Mechanical Couplings, NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe.
 - a. Fiber-reinforced plastic body.
 - b. PE body tube.
 - c. Buna-nitrile seals.
 - d. Acetal collets.
 - e. Stainless-steel bolts, nuts, and washers.
- 7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe.
 - a. Stainless-steel flanges and tube with epoxy finish.
 - b. Buna-nitrile seals.
 - c. Stainless-steel bolts, washers, and nuts.
 - d. Factory-installed anode for steel-body couplings installed underground.

2.3 PIPING SPECIALTIES

- A. Appliance Flexible Connectors:
 - 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
 - 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.

- 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
- 4. Corrugated stainless-steel tubing with polymer coating.
- 5. Operating-Pressure Rating: 0.5 psig.
- 6. End Fittings: Zinc-coated steel.
- 7. Threaded Ends: Comply with ASME B1.20.1.
- 8. Maximum Length: 72 inches
- B. Quick-Disconnect Devices: Comply with ANSI Z21.41.
 - 1. Copper-alloy convenience outlet and matching plug connector.
 - 2. Nitrile seals.
 - 3. Hand operated with automatic shutoff when disconnected.
 - 4. For indoor or outdoor applications.
 - 5. Adjustable, retractable restraining cable.
- C. Y-Pattern Strainers:
 - 1. Body: ASTM A126, Class B, cast iron with bolted cover and bottom drain connection.
 - 2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
 - 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 - 4. CWP Rating: 125 psig.
- D. Basket Strainers:
 - 1. Body: ASTM A126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
 - 2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
 - 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 - 4. CWP Rating: 125 psig.
- E. T-Pattern Strainers:
 - 1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
 - 2. End Connections: Grooved ends.
 - 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
 - 4. CWP Rating: 750 psig.
- F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.4 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.5 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
 - 1. CWP Rating: 125 psig.
 - 2. Threaded Ends: Comply with ASME B1.20.1.
 - 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 - 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 - 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
 - 1. CWP Rating: 125 psig.
 - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 - 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
 - 1. Ball: Chrome-plated brass.
 - 2. Stem: Bronze; blowout proof.
 - 3. Seats: Reinforced TFE; blowout proof.
 - 4. Packing: Separate packnut with adjustable-stem packing threaded ends.
 - 5. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 6. CWP Rating: 600 psig.
 - 7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

- 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - 1. Ball: Chrome-plated bronze.
 - 2. Stem: Bronze; blowout proof.
 - 3. Seats: Reinforced TFE; blowout proof.
 - 4. Packing: Threaded-body packnut design with adjustable-stem packing.
 - 5. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 6. CWP Rating: 600 psig.
 - Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - 1. Body: Bronze, complying with ASTM B584.
 - 2. Ball: Chrome-plated bronze.
 - 3. Stem: Bronze; blowout proof.
 - 4. Seats: Reinforced TFE.
 - 5. Packing: Threaded-body packnut design with adjustable-stem packing.
 - 6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 7. CWP Rating: 600 psig.
 - 8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- G. Bronze Plug Valves: MSS SP-78.
 - 1. Body: Bronze, complying with ASTM B584.
 - 2. Plug: Bronze.
 - 3. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 4. Operator: Square head or lug type with tamperproof feature where indicated.
 - 5. Pressure Class: 125 psig.
 - 6. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- H. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.
 - 1. Body: Cast iron, complying with ASTM A126, Class B.
 - 2. Plug: Bronze or nickel-plated cast iron.
 - 3. Seat: Coated with thermoplastic.
 - 4. Stem Seal: Compatible with natural gas.
 - 5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 6. Operator: Square head or lug type with tamperproof feature where indicated.
 - 7. Pressure Class: 125 psig.

- 8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
- 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- I. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
 - 1. Body: Cast iron, complying with ASTM A126, Class B.
 - 2. Plug: Bronze or nickel-plated cast iron.
 - 3. Seat: Coated with thermoplastic.
 - 4. Stem Seal: Compatible with natural gas.
 - 5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 6. Operator: Square head or lug type with tamperproof feature where indicated.
 - 7. Pressure Class: 125 psig.
 - 8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- J. Valve Boxes:
 - 1. Cast-iron, two-section box.
 - 2. Top section with cover with "GAS" lettering.
 - 3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
 - 4. Adjustable cast-iron extensions of length required for depth of bury.
 - 5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.6 MOTORIZED GAS VALVES

- A. Automatic Gas Valves: Comply with ANSI Z21.21.
 - 1. Body: Brass or aluminum.
 - 2. Seats and Disc: Nitrile rubber.
 - 3. Springs and Valve Trim: Stainless steel.
 - 4. Normally closed.
 - 5. Visual position indicator.
 - 6. Electrical operator for actuation by appliance automatic shutoff device.
- B. Electrically Operated Valves: Comply with UL 429.
 - 1. Pilot operated.
 - 2. Body: Brass or aluminum.
 - 3. Seats and Disc: Nitrile rubber.
 - 4. Springs and Valve Trim: Stainless steel.
 - 5. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
 - 6. NEMA ICS 6, Type 4, coil enclosure.
 - 7. Normally closed.
 - 8. Visual position indicator.

2.7 PRESSURE REGULATORS

- A. General Requirements:
 - 1. Single stage and suitable for natural gas.
 - 2. Steel jacket and corrosion-resistant components.
 - 3. Elevation compensator.
 - 4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.
- B. Service Pressure Regulators: Comply with ANSI Z21.80.
 - 1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 - 2. Springs: Zinc-plated steel; interchangeable.
 - 3. Diaphragm Plate: Zinc-plated steel.
 - 4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 - 5. Orifice: Aluminum; interchangeable.
 - 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - 7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 - 8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 - 9. Overpressure Protection Device: Factory mounted on pressure regulator.
 - 10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 - 11. Maximum Inlet Pressure: 100 psig.
- C. Line Pressure Regulators: Comply with ANSI Z21.80.
 - 1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 - 2. Springs: Zinc-plated steel; interchangeable.
 - 3. Diaphragm Plate: Zinc-plated steel.
 - 4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 - 5. Orifice: Aluminum; interchangeable.
 - 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - 7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 - 8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 - 9. Overpressure Protection Device: Factory mounted on pressure regulator.
 - 10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 - 11. Maximum Inlet Pressure: 10 psig.
- D. Appliance Pressure Regulators: Comply with ANSI Z21.18.
 - 1. Body and Diaphragm Case: Die-cast aluminum.
 - 2. Springs: Zinc-plated steel; interchangeable.

- 3. Diaphragm Plate: Zinc-plated steel.
- 4. Seat Disc: Nitrile rubber.
- 5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
- 6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
- 7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
- 8. Maximum Inlet Pressure: 5 psig.

2.8 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 125 psig minimum at 180 deg F.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Description:
 - a. Standard: ASSE 1079.
 - b. Factory-fabricated, bolted, companion-flange assembly.
 - c. Pressure Rating: 125 psig minimum at 180 deg F.
 - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solderjoint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
 - 1. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.

2.9 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 31 2000 "Earth Moving" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D2774.
- D. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 3. Replace pipe having damaged PE coating with new pipe.
- E. Copper Tubing with Protective Coating:
 - 1. Apply joint cover kits over tubing to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- F. Install fittings for changes in direction and branch connections.
- G. Install pressure gage downstream from each service regulator.

3.4 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe

with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

- 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
- 2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
- 3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
- 4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
- 5. Prohibited Locations:
 - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.
- Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- R. Connect branch piping from top or side of horizontal piping.
- S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- T. Do not use natural-gas piping as grounding electrode.
- U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- V. Install pressure gage downstream from each line regulator.
- W. Install sleeves for piping penetrations of walls, ceilings, and floors.
- X. Install sleeve seals for piping penetrations of concrete walls and slabs.
- Y. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.5 SERVICE-METER ASSEMBLY INSTALLATION

A. Install service-meter assemblies aboveground, on concrete bases.

- B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.
- C. Install strainer on inlet of service-pressure regulator and meter set.
- D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.
- E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.
- F. Install service meters downstream from pressure regulators.
- G. Install metal bollards to protect meter assemblies. Comply with requirements in Section 05 5000 "Metal Fabrications" for pipe bollards.

3.6 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.

3.7 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
- 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
- 2. Bevel plain ends of steel pipe.
- 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified.
- B. Comply with requirements for pipe hangers and supports specified.
- C. Install hangers for steel piping and copper tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Install hangers for corrugated stainless-steel tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping within 12 inches of each fitting.
- F. Support vertical runs of steel piping and copper tubing to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- G. Support vertical runs of corrugated stainless-steel tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.9 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.10 LABELING AND IDENTIFYING

- A. Comply with requirements in specifications and plans for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.11 PAINTING

- A. Comply with requirements in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting" for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (flat).
 - d. Color: Gray.
- C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Topcoat: Interior latex (flat).
 - c. Color: Gray.
 - 2. Alkyd System: MPI INT 5.1E.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Interior alkyd matching topcoat.

- c. Topcoat: Interior alkyd (flat).
- d. Color: Gray.
- D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.12 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - Use 3000-psig, 28-day, compressive-strength concrete and reinforcement as specified in Section 03 3000 "Cast-in-Place Concrete."

3.13 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.14 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.15 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be:
 - 1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.

- B. Aboveground natural-gas piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
 - 3. Annealed-temper copper tube with wrought-copper fittings and brazed joints.
- C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed joints. Install piping embedded in concrete with no joints in concrete.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.16 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground, branch piping NPS 1 and smaller shall be the following:
 - 1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
 - 2. Annealed-temper, tin-lined copper tube with flared joints and fittings.
 - 3. Annealed-temper, copper tube with wrought-copper fittings and brazed joints.
 - 4. Aluminum tube with flared fittings and joints.
 - 5. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
 - 3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
- C. Underground, below building, piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.17 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

- A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:
 - 1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.

- 2. Annealed-temper, tin-lined copper tube with flared joints and fittings.
- 3. Annealed-temper, copper tube with wrought-copper fittings and brazed joints.
- 4. Aluminum tube with flared fittings and joints.
- 5. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with steel welding fittings and welded joints.
 - 3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
- C. Underground, below building, piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.18 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 5 PSIG

- A. Aboveground Piping: Maximum operating pressure more than 5 psig.
- B. Aboveground, Branch Piping: Steel pipe with steel welding fittings and welded joints.
- C. Aboveground, distribution piping shall be one of the following:
 - 1. Steel pipe with steel welding fittings and welded joints.
 - 2. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
- D. Underground, below building, piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
- E. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- F. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.19 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground:
 - 1. PE valves.
 - 2. NPS 2 and Smaller: Bronze plug valves.
 - 3. NPS 2-1/2 and Larger: Cast-iron, nonlubricated plug valves.

3.20 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Bronze plug valve.
- B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:
 1. Bronze plug valve.
 - Cast-iron, nonlubricated plug valve.
- C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Bronze plug valve.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:
 - 1. Bronze plug valve.
 - 2. Cast-iron, lubricated plug valve.
- E. Valves in branch piping for single appliance shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Bronze plug valve.

END OF SECTION

SECTION 22 1123.21 - INLINE, DOMESTIC-WATER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. In-line, sealless centrifugal pumps.
 - 2. Horizontally mounted, in-line, separately coupled centrifugal pumps.
 - 3. Horizontally mounted, in-line, close-coupled centrifugal pumps.
 - 4. Vertically mounted, in-line, close-coupled centrifugal pumps.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction materials, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Sustainable Design Submittals:
 - 1. Product Data: For pump controls.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Detail pumps and adjacent equipment. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Structural members to which pumps will be attached.
 - 2. Size and location of initial access modules for acoustical tile.
- B. Seismic Qualification Data: Certificates, for inline, domestic-water pumps, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

- 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For inline, domestic-water pumps to include in operation and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written instructions for handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: UL 778 for motor-operated water pumps.
- C. Drinking Water System Components Health Effects and Drinking Water System Components Lead Content Compliance: NSF 61 and NSF 372.
- D. Seismic Performance: Inline, domestic-water pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified."
 - 2. Component Importance Factor: 1.0.

2.2 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

- A. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.
- B. Pump Construction:

- 1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
- 2. Minimum Working Pressure: 125 psig.
- 3. Maximum Continuous Operating Temperature: 220 deg F.
- 4. Casing: Bronze, with threaded or companion-flange connections.
- 5. Impeller: stainless steel.
- 6. Motor: Single speed.

2.3 HORIZONTALLY MOUNTED, IN-LINE, SEPARATELY COUPLED CENTRIFUGAL PUMPS

- A. Description: Factory-assembled and -tested, in-line, single-stage, separately coupled, overhungimpeller centrifugal pumps designed for installation with pump and motor shafts mounted horizontal.
- B. Pump Construction:
 - 1. Casing:
 - Radially split bronze with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
 - b. Built to permit servicing of pump internals without disturbing the casing or the suction and discharge piping.
 - c. Gauge port tappings at suction and discharge nozzles.
 - 2. Impeller: Bronze or stainless steel, statically and dynamically balanced, closed, and keyed to shaft.
 - 3. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
 - 4. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
 - 5. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
 - 6. Bearings: permanently lubricated ball type.
 - 7. Minimum Working Pressure: 175 psig.
 - 8. Continuous Operating Temperature: 200 deg F.
- C. Motor: Single speed, with permanently lubricated ball bearings; and resiliently or rigidly mounted to pump casing.

2.4 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

- A. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhungimpeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.
- B. Pump Construction:

- 1. Casing:
 - a. Radially split bronze brass or cast iron with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
 - b. Built to permit servicing of pump internals without disturbing the casing or the suction and discharge piping.
 - c. Gauge port tappings at suction and discharge nozzles.
- 2. Impeller: Bronze or brass, statically and dynamically balanced, closed, and keyed to shaft.
- 3. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
- 4. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
- 5. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
- 6. Bearings: permanently lubricated ball type.
- 7. Minimum Working Pressure: 175 psig.
- 8. Continuous Operating Temperature: 225 deg F.
- C. Motor: Single speed, with grease-lubricated ball bearings; resiliently or rigidly mounted to pump casing.

2.5 VERTICALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

- A. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhungimpeller centrifugal pumps designed for installation with pump and motor shaft mounted vertical.
- B. Pump Construction:
 - 1. Casing: Radially split bronze cast or ductile iron, with wear rings and threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections. Include pump manufacturer's base attachment for mounting pump on concrete base.
 - 2. Impeller: Bronze brass or stainless steel, statically and dynamically balanced, closed, and keyed to shaft.
 - 3. Shaft and Shaft Sleeve: Steel or stainless-steel shaft, with copper-alloy shaft sleeve.
 - 4. Shaft Coupling: Flexible or rigid type if pump is provided with coupling.
 - 5. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.
 - 6. Bearings: Oil-lubricated; bronze-journal or ball type.
 - 7. Minimum Working Pressure: 175 psig.
 - 8. Continuous Operating Temperature: 225 deg F.
- C. Motor: Single speed, with grease-lubricated ball bearings; rigidly mounted to pump casing.

2.6 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 22 0513 "Common Motor Requirements for Plumbing Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for domestic-water-piping system to verify actual locations of piping connections before pump installation.

3.2 PUMP INSTALLATION

- A. Mount pumps in orientation complying with manufacturer's written instructions.
- B. Install thermostats in hot-water return piping.

3.3 PIPING CONNECTIONS

- A. Comply with requirements for piping specified in Section 22 1116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to inline, domestic-water pumps, allow space for service and maintenance.
- C. Connect domestic-water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
 - 1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
 - a. Horizontally mounted, in-line, separately coupled centrifugal pumps.
 - b. Horizontally mounted, in-line, close-coupled centrifugal pumps.
 - c. Vertically mounted, in-line, close-coupled centrifugal pumps.
 - d. Comply with requirements for flexible connectors specified in Section 22 1116 "Domestic Water Piping."
- D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for strainers specified in Section 22 1119 "Domestic Water Piping Specialties." Comply with requirements for valves specified in the following:

- 1. Section 22 0523.12 "Ball Valves for Plumbing Piping."
- 2. Section 22 0523.13 "Butterfly Valves for Plumbing Piping."
- 3. Section 22 0523.14 "Check Valves for Plumbing Piping."
- 4. Section 22 0523.15 "Gate Valves for Plumbing Piping."
- 5. Install pressure gauge and snubber at suction of each pump and pressure gauge and snubber at discharge of each pump. Install at integral pressure-gauge tappings where provided or install pressure-gauge connectors in suction and discharge piping around pumps. Comply with requirements for pressure gauges and snubbers specified in Section 22 0519 "Meters and Gages for Plumbing Piping."

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring between temperature controllers and devices.
- C. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 0553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
- E. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- F. Inline, domestic-water pump will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.7 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Clean strainers on suction piping.
 - 4. Set thermostats, for automatic starting and stopping operation of pumps.
 - 5. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 - 6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - 7. Start motor.
 - 8. Open discharge valve slowly.
 - 9. Adjust temperature settings on thermostats.
 - 10. Adjust timer settings.

3.8 ADJUSTING

- A. Adjust inline, domestic-water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION

SECTION 22 1316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Hub-and-spigot, cast-iron soil pipe and fittings.
 - 2. Hubless, cast-iron soil pipe and fittings.
 - 3. Ductile-iron pipe and fittings.
 - 4. Copper tube and fittings.
 - 5. PVC pipe and fittings.
 - 6. Specialty pipe fittings.
 - 7. Encasement for underground metal piping.
- B. Related Requirements:
 - 1. Section 22 1313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
 - Do not proceed with interruption of sanitary waste service without Owner's written permission.

1.6 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.2 PIPING MATERIALS

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy class(es).
- B. Gaskets: ASTM C 564, rubber.
- C. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
 - 1. Standards: ASTM C 1277 and CISPI 310.

- 2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
 - 1. Standards: ASTM C 1277 and ASTM C 1540.
 - 2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- D. Cast-Iron, Hubless-Piping Couplings:
 - 1. Standard: ASTM C 1277.
 - 2. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 DUCTILE-IRON PIPE AND FITTINGS

- A. Ductile-Iron, Mechanical-Joint Piping:
 - 1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
- B. Ductile-Iron, Push-on-Joint Piping:
 - 1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
- C. Ductile-Iron, Grooved-Joint Piping: AWWA C151/A21.51, with round-cut-grooved ends according to AWWA C606.
- D. Ductile-Iron, Grooved-End Pipe Appurtenances:
 - 1. Grooved-End, Ductile-Iron Fittings: ASTM A 536 ductile-iron castings, with dimensions matching AWWA C110/A 21.10 ductile-iron pipe or AWWA C153/A 21.53 ductile-iron fittings, and complying with AWWA C606 for grooved ends.
 - 2. Grooved Mechanical Couplings for Ductile-Iron Pipe: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber center-leg gasket suitable for hot and cold water; and bolts and nuts.

2.6 COPPER TUBE AND FITTINGS

- A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.
- D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

E. Copper Pressure Fittings:

- 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
- 2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- F. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.
- G. Solvent Cement: ASTM D 2235.
 - 1. Verify solvent cement has a VOC content of 325 g/L or less.
 - 2. Verify solvent cement complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.7 PVC PIPE AND FITTINGS

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
 - 1. Verify adhesive primer complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Solvent Cement: ASTM D 2564.
 - 1. Verify solvent cement has a VOC content of 510 g/L or less.

2.8 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 - 1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - 2. Unshielded, Nonpressure Transition Couplings:
 - a. Standard: ASTM C 1173.

- b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
- c. End Connections: Same size as and compatible with pipes to be joined.
- d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- 3. Shielded, Nonpressure Transition Couplings:
 - a. Standard: ASTM C 1460.
 - b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - c. End Connections: Same size as and compatible with pipes to be joined.
- 4. Pressure Transition Couplings:
 - a. Standard: AWWA C219.
 - b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
 - c. Center-Sleeve Material: Manufacturer's standard.
 - d. Gasket Material: Natural or synthetic rubber.
 - e. Metal Component Finish: Corrosion-resistant coating or material.
- B. Dielectric Fittings:
 - 1. Dielectric Unions:
 - a. Description:
 - 1) Standard: ASSE 1079.
 - 2) Pressure Rating: 125 psig minimum at 180 deg F.
 - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
 - 2. Dielectric Nipples:
 - a. Description:
 - 1) Standard: IAPMO PS 66.
 - 2) Electroplated steel nipple.
 - 3) Pressure Rating: 300 psig at 225 deg F.
 - 4) End Connections: Male threaded or grooved.
 - 5) Lining: Inert and noncorrosive, propylene.

2.9 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.
- C. Form: Sheet or tube.
- D. Color: Black or natural.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 2000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
 - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 - 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Lay buried building waste piping beginning at low point of each system.

- 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
- 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- 3. Maintain swab in piping and pull past each joint as completed.
- K. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- M. Install steel piping according to applicable plumbing code.
- N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- O. Install aboveground PVC piping according to ASTM D 2665.
- P. Install underground PVC piping according to ASTM D 2321.
- Q. Install engineered soil and waste and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 - 2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
 - 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
 - 4. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
- R. Plumbing Specialties:
 - 1. Install backwater valves in sanitary waster gravity-flow piping.
 - a. Comply with requirements for backwater valves specified in Section 22 1319 "Sanitary Waste Piping Specialties."
 - 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
 - a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
 - b. Comply with requirements for cleanouts specified in Section 22 1319 "Sanitary Waste Piping Specialties."

- 3. Install drains in sanitary waste gravity-flow piping.
 - a. Comply with requirements for drains specified in Section 22 1319 "Sanitary Waste Piping Specialties."
- S. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors.
 - 1. Comply with requirements for sleeves specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install sleeve seals for piping penetrations of concrete walls and slabs.
 - 1. Comply with requirements for sleeve seals specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors.
 - 1. Comply with requirements for escutcheons specified in Section 22 0518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
- C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
 - 1. Cut threads full and clean using sharp dies.
 - 2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
 - c. Do not use pipe sections that have cracked or open welds.
- E. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

- F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- G. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in ODs.
 - 2. In Waste Drainage Piping: Unshielded, nonpressure transition couplings.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 4. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 5. Support pipe rolls on trapeze.
 - 6. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install hangers for cast-iron, steel and copper soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- C. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- E. Support vertical runs of cast iron, steel, stainless-steel and copper soil piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

F. Support vertical runs of PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
 - 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 - 5. Comply with requirements for backwater valves, cleanouts and drains specified in Section 22 1319 "Sanitary Waste Piping Specialties."
 - 6. Equipment: Connect waste piping as indicated.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
 - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
 - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
 - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
 - c. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
 - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
 - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. Inspect plumbing fixture connections for gas and water leaks.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

- A. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
 - 3. Copper Type DWV tube, copper drainage fittings, and soldered joints.
 - 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- B. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
 - 3. Copper Type DWV tube, copper drainage fittings, and soldered joints.
 - Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
 - 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- D. Aboveground, vent piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- E. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Extra Heavy Service class, cast-iron soil piping; gaskets; and gasketed calking materials; and calked joints.
 - 2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty cast-iron hubless-piping couplings; and coupled joints.
 - 3. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- F. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
 - 1. Extra Heavy Service class, cast-iron soil piping; gaskets; and gasketed calking materials; and calked joints.
 - 2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty cast-iron hubless-piping couplings; coupled joints.

3. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.

END OF SECTION

SECTION 22 1319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Backwater valves.
 - 2. Cleanouts.
 - 3. Air-admittance valves.
 - 4. Miscellaneous sanitary drainage piping specialties.
- B. Related Requirements:
 - 1. Section 22 1323 "Sanitary Waste Interceptors" for metal and concrete interceptors outside the building, grease interceptors, grease-removal devices, oil interceptors, and solids interceptors.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile butadiene styrene.
- B. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Show fabrication and installation details for frost-resistant vent terminals.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.2 CLEANOUTS

- A. Cast-Iron Exposed Cleanouts:
 - 1. Standard: ASME A112.36.2M.
 - 2. Size: Same as connected drainage piping
 - 3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch, Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 4. Closure: Countersunk or raised-head, brass plug.
 - 5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Stainless Steel Exposed Cleanouts:
 - 1. Standard: ASME A112.3.1.
 - 2. Size: Same as connected drainage piping.
 - 3. Body Material: Stainless steel tee with side cleanout as required to match connected piping.
 - 4. Closure: Stainless steel plug with seal.
- C. Cast-Iron Exposed Floor Cleanouts:
 - 1. Standard: ASME A112.36.2M for adjustable housing threaded, adjustable housing cleanout.
 - 2. Size: Same as connected branch.
 - 3. Type: Adjustable housing Threaded, adjustable housing.
 - 4. Body or Ferrule: Cast iron.
 - 5. Outlet Connection: Inside calk.
 - 6. Closure: Brass plug with straight threads and gasket.
 - 7. Adjustable Housing Material: ' Plastic with threads.
 - 8. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
 - 9. Frame and Cover Shape: Round.
 - 10. Top-Loading Classification: Extra Heavy Duty.
 - 11. Riser: ASTM A74, Extra-Heavy Service Class, cast-iron drainage pipe fitting and riser to cleanout.

- D. Stainless Steel Exposed Floor Cleanouts:
 - 1. Standards: ASME A112.3.1; NSF listed.
 - 2. Size: Same as connected branch.
 - 3. Housing: Type 304 stainless steel.
 - 4. Closure: Stainless steel with seal.
 - 5. Riser: ASTM A74, Extra-Heavy Service Class, drainage pipe fitting and riser to cleanout.
 - 6. Body or Ferrule: Stainless steel.
 - 7. Outlet Connection: Inside caulk.
 - 8. Adjustable Housing Material: Cast iron or Plastic with threads.
 - 9. Frame and Cover Material and Finish: Stainless steel.
 - 10. Frame and Cover Shape: Round.
 - 11. Top-Loading Classification: Extra Heavy Light Medium Duty.
- E. Cast-Iron Wall Cleanouts Insert drawing designation, if any:
 - 1. Standard: ASME A112.36.2M. Include wall access.
 - 2. Size: Same as connected drainage piping.
 - 3. Body: Hub-and-spigot, cast-iron soil pipe T-branch, Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 4. Closure Plug:
 - a. Brass.
 - b. Countersunk or raised head.
 - c. Drilled and threaded for cover attachment screw.
 - d. Size: Same as or not more than one size smaller than cleanout size.
 - 5. Wall Access, Cover Plate: Round, flat, chrome-plated brass or stainless steel cover plate with screw.
 - 6. Wall Access, Frame and Cover: Round, nickel-bronze, copper-alloy, or stainless steel wall-installation frame and cover.

2.3 AIR-ADMITTANCE VALVES

- A. Fixture Air-Admittance Valves:
 - 1. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
 - 2. Housing: Plastic.
 - 3. Operation: Mechanical sealing diaphragm.
 - 4. Size: Same as connected fixture or branch vent piping.
- B. Stack Air-Admittance Valves:
 - 1. Standard: ASSE 1050 for vent stacks.
 - 2. Housing: Plastic.
 - 3. Operation: Mechanical sealing diaphragm.
 - 4. Size: Same as connected stack vent or vent stack.
- C. Wall Box for Air-Admittance Valves:

- 1. Description: White plastic housing with white plastic grille, made for recessed installation. Include bottom pipe connection and space to contain one air-admittance valve.
- 2. Size: Approximately 6 inches wide by 6 inches high by 4 inches deep.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Open Drains:
 - 1. Description: Shop or field fabricate from ASTM A74, Service Class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C564 rubber gaskets.
 - 2. Size: Same as connected waste piping with increaser fitting of size indicated.
- B. Deep-Seal Traps:
 - 1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
 - 2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch-minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.
- C. Floor-Drain, Trap-Seal Primer Fittings Insert drawing designation, if any:
 - 1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
 - 2. Size: Same as floor drain outlet with NPS 1/2 side inlet.
- D. Floor-Drain, Inline Trap Seal:
 - 1. Description: Inline floor drain trap seal, forming a physical barrier to slow trap evaporation while not impeding flow from drain.
 - 2. Material: Polymer.
 - 3. Standard: Tested and certified in accordance with ASSE 1072.
 - 4. Listing: ICC-ES or IAPMO listed.
 - 5. Size: Same as floor drain outlet or strainer throat.
- E. Air-Gap Fittings:
 - 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
 - 2. Body: Bronze or cast iron.
 - 3. Inlet: Opening in top of body.
 - 4. Outlet: Larger than inlet.
 - Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
- F. Sleeve Flashing Device:

- 1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
- 2. Size: As required for close fit to riser or stack piping.
- G. Stack Flashing Fittings:
 - 1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
 - 2. Size: Same as connected stack vent or vent stack.
- H. Vent Caps:
 - 1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
 - 2. Size: Same as connected stack vent or vent stack.
- I. Frost-Resistant Vent Terminals:
 - 1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
 - 2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.
- J. Expansion Joints:
 - 1. Standard: ASME A112.6.4.
 - 2. Body: Cast iron with bronze sleeve, packing, and gland.
 - 3. End Connections: Matching connected piping.
 - 4. Size: Same as connected soil, waste, or vent piping.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install backwater valves in building drain piping.
 - 1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.

- 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install fixture air-admittance valves on fixture drain piping.
- F. Install stack air-admittance valves at top of stack vent and vent stack piping.
- G. Install air-admittance-valve wall boxes recessed in wall.
- H. Assemble open drain fittings and install with top of hub 1 inch above floor.
- I. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- M. Install wood-blocking reinforcement for wall-mounting-type specialties.
- N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 PIPING CONNECTIONS

- A. Comply with requirements in Section 22 1316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. 1. Nameplates and signs are specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

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SECTION 22 1319.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Floor drains.
 - 2. Floor sinks.
 - 3. Trench drains.
 - 4. Channel drainage systems.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene styrene.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene.
- D. PE: Polyethylene.
- E. PP: Polypropylene.
- F. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

- A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

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2.2 FLOOR DRAINS

A. REFERENCE PLUMBING PLANS

2.3 FLOOR SINKS

A. REFERENCE PLUMBING PLANS

2.4 TRENCH DRAINS

A. REFERENCE PLUMBING PLANS

2.5 CHANNEL DRAINAGE SYSTEMS

A. REFERENCE PLUMBING PLANS

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
 - 3. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1inch total depression.
 - 4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
 - a. Maintain integrity of waterproof membranes where penetrated.
 - 5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- B. Install trench drains at low points of surface areas to be drained.
 - 1. Set grates of drains flush with finished surface, unless otherwise indicated.
- C. Comply with ASME A112.3.1 for installation of stainless-steel channel drainage systems.

- 1. Install on support devices, so that top will be flush with adjacent surface.
- D. Install FRP channel drainage system components on support devices, so that top will be flush with adjacent surface.
- E. Install plastic channel drainage system components on support devices, so that top will be flush with adjacent surface.
- F. Install open drain fittings with top of hub 2 inches above floor.

3.2 CONNECTIONS

- A. Comply with requirements in Section 22 1316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements in Section 22 1319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.
- C. Install piping adjacent to equipment to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.4 **PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

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SECTION 22 1513 - GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes piping and related specialties for general-service compressed-air systems, as follows:
 - 1. Pipes, tubes, and fittings.
 - 2. Joining materials.
 - 3. Valves.
 - 4. Dielectric fittings.
 - 5. Flexible pipe connectors.
 - 6. Specialties.
 - 7. Quick couplings.
 - 8. Hose assemblies.
- B. Related Requirements:
 - 1. Section 22 1519 "General-Service Packaged Air Compressors and Receivers" for general-service air compressors and accessories.

1.2 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. HDPE: High-density polyethylene plastic.
- D. High-Pressure, Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures between 150 and 200 psig.
- E. Low-Pressure, Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures of 150 psig or less.
- F. NBR: Nitrile butadiene rubber.
- G. PE: Polyethylene plastic.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Plastic pipes, fittings, and valves.

- 2. Dielectric fittings.
- 3. Flexible pipe connectors.
- 4. Safety valves.
- 5. Pressure regulators. Include rated capacities and operating characteristics.
- 6. Automatic drain valves.
- 7. Filters. Include rated capacities and operating characteristics.
- 8. Lubricators. Include rated capacities and operating characteristics.
- 9. Quick couplings.
- 10. Hose assemblies.

1.4 INFORMATIONAL SUBMITTALS

- A. Certificates:
 - 1. Brazing and welding certificates.
- B. Field Quality-Control Submittals:
 - 1. Field quality-control reports.
- C. Qualification Statements: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For general-service compressed-air piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Extruded-Tee Outlet Procedure: Qualify operators according to training provided by respective manufacturer, for making branch outlets.
 - 2. Press-Seal Joining Procedure for Copper Tubing: Qualify operators according to training provided by respective manufacturer.
 - 3. Pressure-Seal Joining Procedure for Steel Piping. Qualify operators according to training provided by respective manufacturer.
 - 4. Joining Procedures for Aluminum Piping Systems: Qualify installers according to training provided by respective manufacturer.
- B. Brazing: Qualify processes and operators in accordance with ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or with AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
- C. Welding: Qualify processes and operators in accordance with ASME Boiler and Pressure Vessel Code: Section IX.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Compressed-Air Service: Do not interrupt compressed-air service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary compressed-air service according to requirements indicated:
 - 1. Notify Architect, Construction Manager, and Owner no fewer than two days in advance of proposed interruption of compressed-air service.
 - 2. Do not proceed with interruption of compressed-air service without Architect's written permission.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each product type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

2.3 PIPES, TUBES, AND FITTINGS

- A. Copper Tube: ASTM B88, Type K or L seamless, drawn-temper, water tube.
 - 1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
 - 2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
 - 3. Copper Unions: ASME B16.22 or MSS SP-123.
 - 4. Grooved-End Fittings and Couplings, Copper:
 - a. Grooved-End Fittings: ASTM B75/B75M, copper tube or ASTM B584, bronze castings.
 - b. Grooved-End Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for compressed air, and bolts and nuts. Provide EDPM gasket for oil-free compressed air. Provide NBR gasket if compressed air contains oil or oil vapor.
- B. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.4 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

- a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
- b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for generalduty brazing, unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.5 VALVES

A. Metal Ball, Butterfly, Check, and Gate Valves: Comply with requirements in Section 22 0523.12 "Ball Valves for Plumbing Piping," Section 22 0523.13 "Butterfly Valves for Plumbing Piping," Section 22 0523.14 "Check Valves for Plumbing Piping," and Section 22 0523.15 "Gate Valves for Plumbing Piping."

2.6 FLEXIBLE PIPE CONNECTORS

- A. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: 250 psig minimum.
 - 2. End Connections, NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections, NPS 2-1/2 and Larger: Flanged copper alloy.
- B. Stainless Steel-Hose Flexible Pipe Connectors: Corrugated, stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: 250 psig minimum.
 - 2. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.
 - 3. End Connections, NPS 2-1/2 and Larger: Flanged steel nipple.

2.7 SPECIALTIES

- A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
 - 1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
- B. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressuresetting adjustment, and rated for 250 psig inlet pressure, unless otherwise indicated.
 - 1. Type: Pilot operated.

- C. Air-Line Pressure Regulators, Bronze Body: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200 psig minimum inlet pressure, unless otherwise indicated.
- D. Air-Line Pressure Regulators, Aluminum Alloy or Plastic Body: Diaphragm operated, aluminum alloy or plastic body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200 psig minimum inlet pressure, unless otherwise indicated.
- E. Automatic Drain Valves: Stainless steel body and internal parts, rated for 200 psig minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket if wall mounting is indicated.
- F. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Include mounting bracket if wall mounting is indicated.
- G. Mechanical Filters: Two-stage, mechanical-separation, air-line filters. Equip with deflector plates, resin-impregnated-ribbon filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is indicated.
- H. Air-Line Lubricators: With drip chamber and sight dome for observing oil drop entering airstream; with oil-feed adjustment screw and quick-release collar for easy bowl removal. Include mounting bracket if wall mounting is indicated.
 - 1. Provide with automatic feed device for supplying oil to lubricator.

2.8 QUICK COUPLINGS

- A. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.
- B. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless steel or nickel-plated-steel operating parts.
 - 1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
 - 2. Plug End: Flow-sensor-bleeder, check-valve type with barbed outlet for attaching hose.
- C. Valveless Quick Couplings: Straight-through brass body with stainless steel or nickel-platedsteel operating parts.
 - 1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
 - 2. Plug End: With barbed outlet for attaching hose.

2.9 HOSE ASSEMBLIES

- A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300 psig minimum working pressure, unless otherwise indicated.
 - 1. Hose: Reinforced double-wire-braid, CR-covered hose for compressed-air service.
 - 2. Hose Clamps: Stainless steel clamps or bands.
 - 3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
 - 4. Hose Splicers: One-piece, straight-through brass or stainless steel fitting with barbed ends for connecting two sections of hose.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Compressed-Air Piping between Air Compressors and Receivers: Use one of the following piping materials for each size range:
 - 1. NPS 2 Insert pipe size and Smaller, Brazed: Type K or L, copper tube; wrought-copper fittings; and brazed joints.
 - 2. NPS 2-1/2 to NPS 4, Grooved-End, Copper: Type K or L, copper tube; grooved-end copper fittings; couplings; and grooved joints.
- B. Low-Pressure Compressed-Air Distribution Piping: Use one of the following piping materials for each size range:
 - 1. NPS 2 and Smaller, Brazed: Type K or L, copper tube; wrought-copper fittings; and brazed joints.
 - 2. NPS 2-1/2 to NPS 4, Brazed: Type K or L, copper tube; wrought-copper fittings; and brazed joints.
- C. High-Pressure Compressed-Air Distribution Piping: Use one of the following piping materials for each size range:
 - 1. NPS 2 and Smaller, Brazed: Type K or L, copper tube; wrought-copper fittings; and brazed joints.
 - NPS 2-1/2 to NPS 4: Type K or L, copper tube; wrought-copper fittings; and brazed joints.
- D. Drain Piping: Use one of the following piping materials:
 - 1. NPS 2 and Smaller: Type M copper tube; wrought-copper fittings; and brazed or soldered joints.

3.2 VALVE APPLICATIONS

A. Metal General-Duty Valves: Comply with requirements and use valve types specified in "Valve Applications" Article in Section 22 0523.12 "Ball Valves for Plumbing Piping," Section 22 0523.13 "Butterfly Valves for Plumbing Piping," Section 22 0523.14 "Check Valves for Plumbing Piping," and Section 22 0523.15 "Gate Valves for Plumbing Piping," according to the following:

- 1. Low-Pressure Compressed Air: Valve types specified for low-pressure compressed air.
- 2. High-Pressure Compressed Air: Valve types specified for high-pressure compressed air.
- 3. Equipment Isolation NPS 2 and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.
- 4. Grooved-end valves may be used with grooved-end piping and grooved joints.

3.3 INSTALLATION OF PIPING, GENERAL

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless otherwise indicated.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.
- E. Where installing piping adjacent to equipment and machines, allow space for service and maintenance.
- F. Install air and drain piping with 1 percent slope downward in direction of flow.
- G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating unless otherwise indicated.
- H. Equipment and Specialty Flanged Connections:
 - 1. Use steel companion flange with gasket for connection to steel pipe.
 - Use cast-copper-alloy companion flange with gasket and brazed joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.
- I. Extended-tee outlets with brazed branch connection may be used for copper tubing, within extruded-tee connection diameter to run tube diameter ratio for tube type, in accordance with Extruded Tee Connections Sizes and Wall Thickness for Copper Tube (Inches) Table in ASTM F2014.
- J. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
- K. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

- L. Install pressure gauge on discharge piping from each air compressor and on each receiver. Comply with requirements in Section 22 0519 "Meters and Gages for Plumbing Piping."
- M. Install piping to permit valve servicing.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 0518 "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Brazed Joints for Copper Tubing: Join in accordance with AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- E. Grooved Joints: Assemble couplings with housing, gasket, lubricant, and bolts. Join in accordance with AWWA C606 for grooved joints. Do not apply lubricant to prelubricated gaskets.
- F. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.5 INSTALLATION OF VALVES

A. General-Duty Valves: Comply with requirements in Section 22 0523.12 "Ball Valves for Plumbing Piping," Section 22 0523.13 "Butterfly Valves for Plumbing Piping," Section 22 0523.14 "Check Valves for Plumbing Piping," and Section 22 0523.15 "Gate Valves for Plumbing Piping."

3.6 INSTALLATION OF FLEXIBLE PIPE CONNECTORS

- A. Install flexible pipe connectors in discharge piping of each air compressor.
- B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.
- C. Install stainless steel-hose flexible pipe connectors in steel compressed-air piping.

3.7 INSTALLATION OF SPECIALTIES

- A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.
- B. Install air-main pressure regulators in compressed-air piping at or near air compressors.
- C. Install air-line pressure regulators in branch piping to equipment and tools.
- D. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters. Mount on wall at locations indicated.
- E. Install air-line lubricators in branch piping to machine tools. Mount on wall at locations indicated.
- F. Install quick couplings at piping terminals for hose connections.
- G. Install hose assemblies at hose connections.

3.8 PIPING CONNECTIONS

- A. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.
- B. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment and machine.

3.9 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment" for hangers, supports, and anchor devices.
- B. Install hangers for copper tubing and, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

- C. Support horizontal piping within 12 inches of each fitting and coupling.
- D. Support vertical runs of copper tubing to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Individual, Straight, Horizontal Piping Runs:
 - 1. 100 Ft. or Less: MSS Type 1, adjustable, steel clevis hangers.
 - 2. Longer Than 100 Ft.: MSS Type 43, adjustable roller hangers.
- F. Multiple, Straight, Horizontal Piping Runs 100 Ft. or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- G. Base of Vertical Piping: MSS Type 52, spring hangers.

3.10 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.11 FIELD QUALITY CONTROL

- A. Perform field tests and inspections.
- B. Tests and Inspections:
 - 1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - 2. Repair leaks and retest until no leaks exist.
 - 3. Inspect filters, lubricators, and pressure regulators for proper operation.
- C. Prepare test and inspection reports.

END OF SECTION

SECTION 22 3400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Commercial, power-burner, gas-fired, storage, domestic-water heaters.
 - 2. Commercial, power-vent, gas-fired, storage, domestic-water heaters.
 - 3. Commercial, direct-vent, gas-fired, storage, domestic-water heater.
 - 4. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
 - 5. Commercial, coil-type, finned-tube, gas-fired, domestic-water heaters.
 - 6. Commercial, grid-type, finned-tube, gas-fired, domestic-water heaters.
 - 7. Gas-fired, tankless, domestic-water heaters.
 - 8. Residential, direct-vent, gas-fired, storage, domestic-water heaters.
 - 9. Residential, power-vent, gas-fired, storage, domestic-water heaters.
 - 10. Commercial, gas- and oil-fired, domestic-water heaters.
 - 11. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Sustainable Design Submittals:
 - 1. Water Heaters: Product Data for water heater compliance with ASHRAE's "Advanced Energy Design Guides."
- C. Shop Drawings:
 - 1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale, on which the items described in this Section are shown and coordinated with all building trades.
- B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

- C. Source quality-control reports.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of fuel-fired, domesticwater heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Controls and Other Components: Two year(s).
 - b. Commercial, Finned-Tube, Gas-Fired, Domestic-Water Heaters:
 - 1) Heat Exchanger: Five years.
 - 2) Controls and Other Components: Two year(s).
 - 3) Separate Hot-Water Storage Tanks: Five years.
 - c. Gas-Fired, Tankless, Domestic-Water Heaters:
 - 1) Heat Exchanger: Five years.
 - 2) Controls and Other Components: Three years.
 - d. Residential, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Controls and Other Components: Three years.

- e. Commercial, Gas- and Oil-Fired, Domestic-Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Burner: Two year(s).
 - 3) Controls and Other Components: Two years.
- f. Expansion Tanks: Five years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
- B. ASHRAE/IES Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IES 90.1.
- C. ASME Compliance:
 - 1. Where ASME-code construction is indicated, fabricate and label commercial, domesticwater heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2. Where ASME-code construction is indicated, fabricate and label commercial, finnedtube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

- A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Bradford White Corporation.
 - c. Lochinvar, LLC.
 - d. PVI; A WATTS Brand.
 - e. Rheem Manufacturing Company.
 - f. State Industries.
 - 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - 3. Standard: ANSI Z21.10.3/CSA 4.3.
 - 4. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.

- a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
- b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potablewater tank linings, including extending finish into and through tank fittings and outlets.
- c. Lining: Cement, Glass, Nickel plate, Phenolic coating, Sheet copper, complying with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
- 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner: For use with atmospheric, gas-fired, domestic-water heaters and naturalgas fuel.
 - g. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
 - h. Temperature Control: Adjustable thermostat.
 - i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
- 6. Special Requirements: NSF 5 construction.
- 7. Draft Hood: Draft diverter, complying with ANSI Z21.12.
- B. Commercial, Power-Burner, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Precision Boilers.
 - c. PVI; A WATTS Brand.
 - d. State Industries.

- 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
- 3. Standard: ANSI Z21.10.3/CSA 4.3.
- 4. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
 - b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potablewater tank linings, including extending finish into and through tank fittings and outlets.
 - c. Lining: Cement, Glass, Nickel plate, Phenolic coating, Sheet copper, complying with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
- 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner: UL 795 for power-burner, gas-fired, domestic-water heaters and naturalgas fuel.
 - g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
 - h. Temperature Control: Adjustable thermostat.
 - Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
- 6. Draft Hood: Draft diverter, complying with ANSI Z21.12.
- C. Commercial, Power-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Bradford White Corporation.
 - c. Rheem Manufacturing Company.

- d. State Industries.
- 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
- 3. Standard: ANSI Z21.10.3/CSA 4.3.
- 4. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
- 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner: For use with power-vent, gas-fired, domestic-water heaters and natural-gas fuel.
 - g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
 - h. Temperature Control: Adjustable thermostat.
 - Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
- 6. Special Requirements: NSF 5 construction.
- 7. Power-Vent System: Exhaust fan, interlocked with burner.
- D. Commercial, Direct-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bradford White Corporation.
 - b. Lochinvar, LLC.
 - c. State Industries.
 - 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

- 3. Standard: ANSI Z21.10.1/CSA 4.1.
- 4. Storage-Tank Construction: Steel.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potablewater tank linings, including extending lining material into tappings.
- 5. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1.
 - e. Jacket: Steel with enameled finish.
 - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - g. Burner: For use with direct-vent, gas-fired, domestic-water heaters and natural-gas fuel.
 - h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
 - i. Temperature Control: Adjustable thermostat.
 - j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
- 6. Direct-Vent System: Through-wall or roof, coaxial- or double-channel vent assembly with domestic-water heater manufacturers' outside intake/exhaust screen.
- E. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Bradford White Corporation.
 - c. PVI; A WATTS Brand.
 - d. Rheem Manufacturing Company.
 - e. State Industries.
 - 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - 3. Standard: ANSI Z21.10.3/CSA 4.3.
 - 4. Description: Manufacturer's proprietary design to provide at least 95 percent combustion efficiency at optimum operating conditions.
 - 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.

- b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
- c. Drain Valve: Corrosion-resistant metal with hose-end connection.
- d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
- e. Jacket: Steel with enameled finish.
- f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
- g. Temperature Control: Adjustable thermostat.
- h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
- i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
- 6. Draft Hood: Draft diverter, complying with ANSI Z21.12.

2.3 COMMERCIAL, FINNED-TUBE, GAS-FIRED, DOMESTIC-WATER HEATERS

- A. Commercial, Coil-Type, Finned-Tube, Gas-Fired, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Bradford White Corporation.
 - c. Laars Heating Systems Company; a subsidiary of Bradford White Corporation.
 - d. Raypac.
 - 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - 3. Standard: ANSI Z21.13/CSA 4.9 for hot-water-supply boilers.
 - 4. Description: Packaged unit with boiler, separate hot-water storage tank, pump, piping, and controls.
 - 5. Boiler Construction: ASME code with 160-psig working-pressure rating for hot-watersupply boiler, domestic-water heater.
 - a. Heat Exchanger: Helix or spiral, finned-copper-tube coils with bronze headers.
 - b. Connections: Factory fabricated of materials compatible with boiler. Attach to boiler before testing.
 - 1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
 - 6. Boiler Appurtenances:

- a. Insulation: Comply with ASHRAE/IES 90.1. Surround entire boiler except connections and controls.
- b. Jacket: Steel with enameled finish.
- c. Burner: For use with coil-type, finned-tube, gas-fired, domestic-water heaters and natural-gas fuel.
- d. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 60730-2-5, intermittent electronic-ignition system.
- e. Temperature Control: Adjustable, storage-tank temperature-control fitting and flow switch, interlocked with circulator and burner.
- f. Safety Control: Automatic, high-temperature-limit cutoff device or system.
- 7. Support: Steel base or skids.
- 8. Draft Hood: Draft diverter, complying with ANSI Z21.12.
- 9. Hot-Water Storage Tank: Connected with piping to circulating pump and domestic-water heater.
 - a. Construction: In accordance with ASME Boiler and Pressure Vessel Code: Section VIII, steel with 150-psig working-pressure rating.
 - b. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potablewater tank linings, including extending finish into and through tank fittings and outlets.
- 10. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rods: Factory installed, magnesium.
 - b. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - c. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
 - d. Jacket: Steel with enameled finish.
 - e. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
- 11. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately coupled in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig minimum working-pressure rating, and 225 deg F continuous-water-temperature rating.
- 12. Piping: Copper tubing; copper, solder-joint fittings; and brazed or flanged joints.
- 13. Mounting: Domestic-water heater, tank, and accessories factory mounted on skids.
- B. Commercial, Grid-Type, Finned-Tube, Gas-Fired, Domestic-Water Heaters:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Bradford White Corporation.
 - c. Laars Heating Systems Company; a subsidiary of Bradford White Corporation.
 - d. Lochinvar, LLC.
 - e. Raypak.
 - f. RBI.
 - g. Rheem Manufacturing Company.
- 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
- 3. Standard: ANSI Z21.13/CSA 4.9 for hot-water-supply boilers.
- 4. Description: Packaged unit with boiler, storage tank, pump, piping, and controls.
- Boiler Construction: ASME code with 160-psig working-pressure rating for hot-waterboiler-type, domestic-water heater.
 - a. Heat Exchanger: Horizontal, straight, finned-copper tubes with bronze headers.
 - b. Connections: Factory fabricated of materials compatible with boiler. Attach to boiler before testing.
 - 1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
- 6. Boiler Appurtenances:
 - a. Insulation: Comply with ASHRAE/IES 90.1. Surround entire boiler except connections and controls.
 - b. Jacket: Steel with enameled finish.
 - c. Burner: For use with grid-type, finned-tube, gas-fired, domestic-water heaters and natural-gas fuel.
 - d. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 60730-2-5, intermittent electronic-ignition system.
 - e. Temperature Control: Adjustable, storage-tank temperature-control fitting and flow switch, interlocked with circulator and burner.
 - f. Safety Control: Automatic, high-temperature-limit cutoff device or system.
- 7. Support: Steel base or skids.
- 8. Draft Hood: Draft diverter, complying with ANSI Z21.12.
- 9. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rods: Factory installed, magnesium.
 - b. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - c. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
 - d. Jacket: Steel with enameled finish.

- e. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
- 10. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately coupled in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig minimum working-pressure rating, and 225 deg F continuous-water-temperature rating.
- 11. Piping: Copper tubing; copper, solder-joint fittings; and brazed or flanged joints.
- 12. Mounting: Domestic-water heater, tank, and accessories factory mounted on skids.

2.4 GAS-FIRED, TANKLESS, DOMESTIC-WATER HEATERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. A. O. Smith Corporation.
 - 2. Bradford White Corporation.
 - 3. Laars Heating Systems Company; a subsidiary of Bradford White Corporation.
 - 4. NORITZ America Corp.
 - 5. Rheem Manufacturing Company.
 - 6. Rinnai Corporation.
 - 7. State Industries.
- B. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
- C. Standard: ANSI Z21.10.3/CSA 4.3 for gas-fired, instantaneous, domestic-water heaters for indoor application.
- D. Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.
 - 1. Tappings: ASME B1.20.1 pipe thread.
 - 2. Pressure Rating: 150 psig.
 - 3. Heat Exchanger: Copper tubing or Stainless steel.
 - 4. Insulation: Comply with ASHRAE/IES 90.1.
 - 5. Jacket: Metal, with enameled finish, or plastic.
 - 6. Burner: For use with tankless, domestic-water heaters and natural-gas fuel.
 - 7. Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
 - 8. Temperature Control: Adjustable thermostat.
- E. Support: Bracket for wall mounting.

2.5 RESIDENTIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Residential, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Bradford White Corporation.
 - c. Lochinvar, LLC.
 - d. Rheem Manufacturing Company.
 - e. State Industries.
- 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
- 3. Standard: ANSI Z21.10.1/CSA 4.1.
- 4. Storage-Tank Construction: Steel.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
- 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1.
 - e. Jacket: Steel with enameled finish.
 - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - g. Burner: For use with atmospheric, gas-fired, domestic-water heaters and naturalgas fuel.
 - h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
 - i. Temperature Control: Adjustable thermostat.
 - j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
- 6. Draft Hood: Low-profile-type draft diverter, complying with ANSI Z21.12.
- B. Residential, Direct-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Bradford White Corporation.
 - c. Lochinvar, LLC.
 - d. Rheem Manufacturing Company.
 - e. State Industries.

- 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
- 3. Standard: ANSI Z21.10.1/CSA 4.1.
- 4. Storage-Tank Construction: Steel.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potablewater tank linings, including extending lining material into tappings.
- 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1.
 - e. Jacket: Steel with enameled finish.
 - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - g. Burner: For use with direct-vent, gas-fired, domestic-water heaters and natural-gas fuel.
 - h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
 - i. Temperature Control: Adjustable thermostat.
 - j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
- 6. Direct-Vent System: Through-wall or roof, coaxial- or double-channel vent assembly with domestic-water heater manufacturers' outside intake/exhaust screen.
- C. Residential, Power-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - 2. Standard: ANSI Z21.10.1/CSA 4.1.
 - 3. Storage-Tank Construction: Steel.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potablewater tank linings, including extending lining material into tappings.
 - 4. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1.

- e. Jacket: Steel with enameled finish.
- f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
- g. Burner: For use with power-vent, gas-fired, domestic-water heaters and natural-gas fuel.
- h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
- i. Temperature Control: Adjustable thermostat.
- j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
- 5. Power-Vent System: Exhaust fan, interlocked with burner.

2.6 COMMERCIAL, GAS- AND OIL-FIRED, DOMESTIC-WATER HEATERS

- A. Description: Comply with ANSI Z21.10.3/CSA 4.3 or UL 732 requirements appropriate for dual-fuel, gas- and oil-fired, domestic-water heaters.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. A. O. Smith Corporation.
 - 2. Precision Boilers.
 - 3. PVI; A WATTS Brand.
 - 4. State Industries.
- C. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
- D. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.
 - 1. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a. NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - b. NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
- E. Factory-Installed, Storage-Tank Appurtenances:
 - 1. Anode Rod: Replaceable magnesium.
 - 2. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - 3. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - 4. Insulation: Comply with ASHRAE/IES 90.1.
 - 5. Jacket: Steel with enameled finish.
 - 6. Temperature Control: Adjustable thermostat.

- 7. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
- F. Fuel Burner:
 - 1. Standards: Combination gas-and-oil burner assembly, complying with appropriate requirements of UL 795; or comply with UL 296 for oil burners for No. 2 fuel oil and UL 795 for natural-gas fuel.
 - 2. Safety Control: Automatic, high-temperature-limit cutoff device or system.
 - 3. Vent Connection: In accordance with standards of authorities having jurisdiction for dual-fuel, domestic-water heaters.

2.7 DOMESTIC-WATER HEATER ACCESSORIES

- A. Domestic-Water Expansion Tanks:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. AMTROL, Inc.
 - c. State Industries.
 - d. TACO Comfort Solutions, Inc.
 - 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - Description: Steel, pressure-rated tank constructed with welded joints and factoryinstalled, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 - 4. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potablewater tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
 - 5. Capacity and Characteristics:
 - a. Working-Pressure Rating: 150 psig.
 - b. Capacity Acceptable: 2 gal. minimum.
 - c. Air Precharge Pressure: 20 psig.
- B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.

- C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.
- D. Heat-Trap Fittings: ASHRAE 90.2.
- E. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 22 0523.12 "Ball Valves for Plumbing Piping," Section 22 0523.13 "Butterfly Valves for Plumbing Piping," and Section 22 0523.15 "Gate Valves for Plumbing Piping."
 - 1. Comply with requirements for balancing valves specified in Section 22 1119 "Domestic Water Piping Specialties."
- F. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1, manually operated. Furnish for installation in piping.
- G. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.
- H. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.
- I. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
 - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
 - 2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.
- J. Pressure Relief Valves: Include pressure setting less than working-pressure rating of domesticwater heater.
 - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
 - 2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.
- K. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- L. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater minimum of 18 inches above the floor.
- M. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.8 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.

- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 03 3000 "Castin-Place Concrete."
 - 1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 - 2. Maintain manufacturer's recommended clearances.
 - 3. Arrange units so controls and devices that require servicing are accessible.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 8. Anchor domestic-water heaters to substrate.
- B. Residential, Domestic-Water Heater Mounting: Install residential domestic-water heaters on water-heater stand on floor or domestic-water heater mounting bracket.
 - 1. Maintain manufacturer's recommended clearances.
 - 2. Arrange units so controls and devices that require servicing are accessible.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Anchor domestic-water heaters to substrate.
- C. Tankless, Domestic-Water Heater Mounting: Install tankless, domestic-water heaters at least 18 inches above floor on wall bracket.
 - 1. Maintain manufacturer's recommended clearances.
 - 2. Arrange units so controls and devices that require servicing are accessible.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Anchor domestic-water heaters to substrate.
- D. Install domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

- Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 0523.12 "Ball Valves for Plumbing Piping," Section 22 0523.13 "Butterfly Valves for Plumbing Piping," and Section 22 0523.15 "Gate Valves for Plumbing Piping."
- E. Install gas-fired, domestic-water heaters in accordance with NFPA 54.
 - 1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
 - 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 - 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
 - 4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 23 1123 "Facility Natural-Gas Piping."
- F. Install oil-fired, domestic-water heaters in accordance with NFPA 31.
 - Install shutoff valves on fuel-oil supply piping to oil-fired water-heater burners without shutoff valves. Comply with requirements for shutoff valves specified in Section 23 1113 "Facility Fuel-Oil Piping."
- G. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- H. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- I. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 1119 "Domestic Water Piping Specialties."
- J. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 22 0519 "Meters and Gages for Plumbing Piping."
- K. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 22 0523.12 "Ball Valves for Plumbing Piping," Section 22 0523.13 "Butterfly Valves for Plumbing Piping," and Section 22 0523.15 "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 22 0519 "Meters and Gages for Plumbing Piping."

- L. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- M. Fill domestic-water heaters with water.
- N. Charge domestic-water expansion tanks with air to required system pressure.
- O. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.2 PIPING CONNECTIONS

- A. Comply with requirements for domestic-water piping specified in Section 22 1116 "Domestic Water Piping."
- B. Comply with requirements for fuel-oil piping specified in Section 23 1113 "Facility Fuel-Oil Piping."
- C. Comply with requirements for gas piping specified in Section 23 1123 "Facility Natural-Gas Piping."
- D. Drawings indicate general arrangement of piping, fittings, and specialties.
- E. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

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3.5 DEMONSTRATION

Train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, Α. storage, gas-fired, tankless commercial, gas- and oil-fired, domestic-water heaters. Training shall be a minimum of one hour(s).

END OF SECTION

SECTION 22 4216.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Service sinks.
 - 2. Kitchen/utility sinks.
 - 3. Handwash sinks.
 - 4. Manually operated sink faucets.
 - 5. Automatically operated sink faucets.
 - 6. Supply fittings.
 - 7. Waste fittings.
 - 8. Sink supports.
 - 9. Grout.
- B. Related Requirements:
 - 1. Section 11 4000 "Foodservice Equipment" for NSF-compliant foodservice and handwash sinks.
 - 2. Section 22 4100 "Residential Plumbing Fixtures" for residential sinks.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Sustainable Design Submittals:
 - 1. Plumbing Fixtures: Provide the following:
 - a. Manufacturer cut sheet indicating water consumption.
 - b. WaterSense certification for residential fixtures, commercial water closets, commercial urinals, and commercial showers.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted sinks.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sinks and faucets to include in operation and maintenance manuals.
 - 1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:
 - a. Servicing and adjustments for automatic faucets.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
 - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SERVICE SINKS

- A. Service Sinks Molded Stone, Floor Mounted: .
 - 1. Source Limitations: Obtain sinks from single source from single manufacturer.
 - 2. Fixture:
 - a. Standard: ASME A112.18.2/CSA B125.2.
 - b. Shape: Square.
 - c. Nominal Size: 24 by 24 inches.
 - d. Height: 10 inches.
 - e. Rim Guard: On all top surfaces.
 - f. Color: Not applicable.
 - g. Drain: Grid with NPS 3 outlet.
 - 3. Mounting: On floor and flush to wall.
- B. Service Sinks Enameled Cast Iron, Trap Standard Mounted: .
 - 1. Source Limitations: Obtain sinks from single source from single manufacturer.
 - 2. Fixture:
- a. Standard: ASME A112.19.1/CSA B45.2.
- b. Type: Service sink with back.
- c. Back: Two faucet holes.
- d. Nominal Size: 22 by 18 inches.
- e. Color: White.
- f. Mounting: NPS 3 P-trap standard with grid strainer inlet, cleanout, and floor flange.
- g. Rim Guard: On front and sides.
- C. Service Sinks Enameled Cast Iron, Floor Mounted: .
 - 1. Source Limitations: Obtain sinks from single source from single manufacturer.
 - 2. Fixture:
 - a. Standard: ASME A112.19.1/CSA B45.2.
 - b. Style: With front apron and raised back.
 - c. Nominal Size: 28 by 28 inches.
 - d. Color: White.
 - e. Drain: Grid with NPS 3 outlet.
 - f. Rim Guard: Coated wire.

2.2 HANDWASH SINKS

- A. Handwash Sinks Stainless Steel: .
 - 1. Source Limitations: Obtain sinks from single source from single manufacturer.
 - 2. Fixture:
 - a. Standards:
 - 1) ASME A112.19.3/CSA B45.4.
 - 2) NSF 61.
 - b. Type: Wall-mounted stainless steel basin with radius corners, back for faucet, and support brackets.
 - c. Overall Dimensions: 17 by 16 by 5 inches.
 - d. Material: 18 gauge, Type 304 stainless steel.
 - 3. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
 - 4. Waste Fittings: Comply with requirements in "Waste Fittings" Article.

2.3 MANUALLY OPERATED SINK FAUCETS

- A. Sink faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
- B. Commercial Sink Faucets Manual Type: Single-control mixing,.

- 1. Source Limitations: Obtain sink faucets from single source from single manufacturer.
- 2. Standard: ASME A112.18.1/CSA B125.1.
- 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
- 4. Body Type: Centerset.
- 5. Body Material: Commercial, solid brass, or die-cast housing with brazed copper and brass waterway.
- 6. Finish: Chrome plated.
- 7. Maximum Flow Rate: 1.0 to 1.28 gpm.
- 8. Mounting Type: Deck, exposed or Back/wall, exposed.
- 9. Valve Handle(s): Lever 4-inch wrist blade.
- 10. Spout Type: Swivel gooseneck.
- 11. Vacuum Breaker: Required for hose outlet.
- 12. Spout Outlet: Hose thread in accordance with ASME B1.20.7.
- 13. Pre-Rinse Unit:
 - a. Style: Flexible hose.
 - b. Riser: 18-inch rigid riser.
 - c. Hose: 44-inch flexible stainless steel with heat-resistant handle.
 - d. Wall bracket.
- C. Commercial Service Sink Faucets Manual Type: .
 - 1. Source Limitations: Obtain sink faucets from single source from single manufacturer.
 - 2. Description: Wall/back mounted, brass body, with integral service stops, checks, spout with bucket/pail hook, 3/4-inch hose thread end, integral vacuum breaker, inlets 8 inches o.c., and two-handle mixing.
 - 3. Faucet:
 - a. Standards:
 - 1) ASME A112.18.1/CSA B125.1.
 - 2) NSF 61 and NSF 372.
 - 3) ICC A117.1.
 - 4) ASSE 1001 (VB).
 - b. Finish: Polished chrome plated.
 - c. Handles: Lever 6-inch wrist blade.
 - d. Cartridges: One-fourth turn compression Ceramic.
 - e. Brace: Adjustable top brace.

2.4 AUTOMATICALLY OPERATED SINK FAUCETS

A. Sink faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

- B. Commercial Sink Faucets Automatic Type: Battery-powered, electronic-sensor-operated, mixing.
 - 1. Source Limitations: Obtain sink faucets from single source from single manufacturer.
 - 2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
 - 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 - 5. Body Type: Centerset.
 - 6. Body Material: Commercial, solid brass, or die-cast housing with brazed copper and brass waterway.
 - 7. Finish: Chrome plated.
 - 8. Maximum Flow Rate: 0.5 gpm.
 - 9. Mounting Type: Deck.
 - 10. Spout Type: Swivel, gooseneck.
 - 11. Spout Outlet: Aerator.
 - 12. Thermostatic Mixing Valve: Below deck, adjustable temperature manual side handle, with hot/cold water indicators, with check valves.
 - 13. Control Module: Below deck, water-resistant module with internal flow setting switches.

2.5 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless steel wall flange.
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Wheel handle.
- F. Risers:
 - 1. NPS 1/2.
 - 2. Chrome-plated, rigid-copper pipe.

2.6 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
- C. Trap:

- 1. Size: NPS 1-1/2.
- 2. Material:
 - a. Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.

2.7 SINK SUPPORTS

- A. Sink Carrier:
 - 1. Source Limitations: Obtain sink supports from single source from single manufacturer.
 - 2. Standard: ASME A112.6.1M.

2.8 GROUT

- A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000 psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sinks level and plumb in accordance with rough-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Install wall-mounted sinks at accessible mounting height in accordance with ICC A117.1.
- D. Set floor-mounted sinks in leveling bed of cement grout.
- E. Install water-supply piping with stop on each supply to each sink faucet.

- 1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 22 0523.12 "Ball Valves for Plumbing Piping" and Section 22 0523.15 "Gate Valves for Plumbing Piping."
- 2. Install stops in locations where they can be easily reached for operation.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 0518 "Escutcheons for Plumbing Piping."
- G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildewresistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 9200 "Joint Sealants."
- H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 22 0719 "Plumbing Piping Insulation."

3.3 PIPING CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 22 1116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 1316 "Sanitary Waste and Vent Piping."

3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 26 0526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 26 0553 "Identification for Electrical Systems."
 - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.5 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.6 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 4500 - EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Combination units.
 - 2. Water-tempering equipment.

1.3 DEFINITIONS

- A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
- C. Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid-solution supply.
- D. Tepid: Moderately warm.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and mounting attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For emergency plumbing fixtures to include in operation and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. ISEA Standard: Comply with ISEA Z358.1.
- B. NSF Standard: Comply with NSF 61 and NSF 372, for fixture materials that will be in contact with potable water.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1,; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

2.2 COMBINATION UNITS

- A. Barrier Free, Plumbed Emergency Shower with Eye/Face Wash Combination Units
 - 1. Approved Equals: Haws, Bradley, Guardian
 - 2. Piping:
 - a. Material: Galvanized steel.
 - b. Unit Supply: NPS 1-1/4 minimum.
 - c. Unit Drain: Outlet at back or side near bottom.
 - 3. Shower:
 - a. Capacity: Not less than 20 gpm for at least 15 minutes.
 - b. Supply Piping: NPS 1 with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Pull rod.
 - d. Shower Head: 8-inch-minimum diameter, plastic.
 - e. Mounting: Pedestal.
 - 4. Eye/Face Wash Unit:
 - a. Capacity: Not less than 3.0 gpm for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.

- d. Spray-Head Assembly: Two or four receptor-mounted spray heads.
- e. Receptor: Stainless-steel bowl.
- f. Mounting: Attached to shower pedestal.

2.3 WATER-TEMPERING EQUIPMENT

- A. Hot- and Cold-Water, Water-Tempering Equipment:
 - 1. Approved Equals: Lawler, Guardian, Haws
 - 2. Description: Factory-fabricated equipment with thermostatic mixing valve.
 - a. Thermostatic Mixing Valve: Designed to provide 80 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
 - b. Supply Connections: For hot and cold water.

2.4 SOURCE QUALITY CONTROL

A. Certify performance of emergency plumbing fixtures by independent testing organization acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF EMERGENCY PLUMBING FIXTURE INSTALLATION

- A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
- B. Install fixtures level and plumb.
- C. Fasten fixtures to substrate.
- D. Install shutoff valves in water-supply piping to fixtures, to facilitate maintenance of the equipment. Use ball or gate valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 22 0523.12 "Ball Valves for Plumbing Piping" and Section 22 0523.15 "Gate Valves for Plumbing Piping."

- E. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Section 22 1116 "Domestic Water Piping."
- F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Comply with requirements for thermometers specified in Section 22 0519 "Meters and Gages for Plumbing Piping."
- G. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system. Comply with requirements for waste piping specified in Section 22 1316 "Sanitary Waste and Vent Piping."
- H. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Section 22 0518 "Escutcheons for Plumbing Piping."
- 1. Fill self-contained fixtures with flushing fluid.

3.3 CONNECTIONS

- A. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for hot- and cold-water piping specified in Section 22 1116 "Domestic Water Piping."
- B. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary waste and vent piping. Comply with requirements for waste piping specified in Section 22 1316 "Sanitary Waste and Vent Piping."
- C. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.4 IDENTIFICATION

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

- A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection.

- 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
- 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust or replace fixture flow regulators for proper flow.
- B. Adjust equipment temperature settings.

END OF SECTION

SECTION 22 4716 - PRESSURE WATER COOLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pressure water coolers.
 - 2. Bottle filling stations.
 - 3. Supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of pressure water cooler and bottle filling station.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
 - 1. Include diagrams for power wiring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers and bottle filling stations to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filter Cartridges: Equal 10 percent of quantity installed for each type and size indicated, but no fewer than 2 of each.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Standards:
 - 1. Pressure water coolers and bottle filling stations intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 or NSF 372, or be certified in compliance with NSF 61 or NSF 372 by an ANSI-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
 - 2. Comply with ASHRAE 34 for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.
 - 3. Comply with UL 399.
 - 4. Comply with ASME A112.19.3/CSA B45.4.
 - 5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - Comply with NSF 42 and NSF 53 for water filters for water coolers and bottle filling stations.
 - 7. Comply with ICC A117.1 for accessible water coolers and bottle filling stations.

2.2 PRESSURE WATER COOLERS

- A. Pressure Water Coolers Surface Wall-Mounted, Light Gray Granite:
 - 1. Approved equals: Elkay, Oasis
 - 2. Source Limitations: Obtain surface wall-mounted, stainless steel, pressure water coolers from single source from single manufacturer.
 - 3. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
 - 4. Control: Push bar
 - 5. Bottle Filler: Sensor activation, with automatic shutoff timer
 - 6. Drain: Grid with NPS 1-1/4tailpiece.
 - 7. Supply: NPS 3/8with shutoff valve.
 - 8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4brass P-trap.
 - 9. Filter: One or more water filters with capacity sized for unit peak flow rate.
 - 10. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - 11. Support: Water-cooler carrier.
 - 12. Water-Cooler Mounting Height: Reference plans for mounting height
 - 13. Capacities and Characteristics:
 - a. Cooled Water: 8 gph
 - b. Ambient-Air Temperature: 90 deg F
 - c. Inlet-Water Temperature: 80 deg F
 - d. Cooled-Water Temperature: 50 deg F
 - e. Electrical Characteristics:
 - 1) Volts: 120 V ac.
 - 2) Phase: Single.

- 3) Hertz: 60 Hz.
- 4) Full-Load Amperes: 6 A.

2.3 SUPPORTS

A. Water-Cooler Carrier:I. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fixtures level and plumb according to roughing-in drawings.
- B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- C. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers, and bottle filling stations to mounting frames.
- D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 22 0523.12 "Ball Valves for Plumbing Piping".
- E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 0518 "Escutcheons for Plumbing Piping."
- G. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 9200 "Joint Sealants."

3.3 PIPING CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 22 1116 "Domestic Water Piping."
- C. Install ball shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section 22 0523.12 "Ball Valves for Plumbing Piping"
- D. Comply with soil and waste piping requirements specified in Section 22 1316 "Sanitary Waste and Vent Piping."

3.4 ELECTRICAL CONNECTIONS

- A. Ground equipment according to Section 26 0526 "Grounding and Bonding for Electrical Systems."
- B. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- C. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplates to be laminated acrylic or melamine plastic signs, as specified in Section 26 0553 "Identification for Electrical Systems."
 - 2. Nameplates to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inchhigh.

3.5 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust pressure water-cooler temperature settings.

3.6 CLEANING

- A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
- C. Provide protective covering for installed fixtures.
- D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 0510 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 23.

1.2 SUMMARY

- A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:
 - 1. Submittals.
 - 2. Coordination drawings.
 - 3. Record documents.
 - 4. Maintenance manuals.
 - 5. Rough-ins.
 - 6. Mechanical installations.
 - 7. Cutting and patching.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 23 Section "BASIC MECHANICAL MATERIALS AND METHODS," for materials and methods common to the remainder of Division 23, plus general related specifications including:
 - a. Access to mechanical installations.

1.3 SUBMITTALS

- A. General: Follow the procedures specified in Division 1 Section "SUBMITTALS."
- B. Increase, by the quantity listed below, the number of mechanical related shop drawings, product data, and samples submitted, to allow for required distribution plus two copies of each submittal required, which will be retained by the Mechanical Consulting Engineer.
 - 1. Shop Drawings Initial Submittal: 1 additional blue- or black-line prints.
 - 2. Shop Drawings Final Submittal: 1 additional blue- or black-line prints.
 - 3. Product Data: 1 additional copy of each item.
 - 4. Samples: 1 addition as set.
- C. Additional copies may be required by individual sections of these Specifications.

1.4 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, indicate the following installed conditions:
 - 1. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - 2. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
 - 3. Contract Modifications, actual equipment and materials installed.

1.5 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, include the following information for equipment items:
 - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - 2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
 - 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 4. Servicing instructions and lubrication charts and schedules.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.7 WARRANTIES

A. Warranties shall begin at date of final completion. All compressors shall include a minimum of five years warranty. One year warranty for labor, parts, units, etc. is required for all equipment. Additionally, Contractor is responsible for all preventative maintenance and routine service on installed equipment for the one year warranty period in order to maintain all factory/manufacturer warranties.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

3.2 MECHANICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
 - 1. Coordinate mechanical systems, equipment, and materials installation with other building components.
 - 2. Verify all dimensions by field measurements.
 - 3. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 - 4. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 - 5. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 - 6. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 - 7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
 - 8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 - 9. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
 - Install access panel or doors where units are concealed behind finished surfaces. Access panels
 and doors are specified in Division 8 Section "ACCESS DOORS" and Division 23 Section
 "BASIC MECHANICAL MATERIALS AND METHODS."

11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.3 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:
 - 1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 - 1. Uncover Work to provide for installation of ill-timed Work.
 - 2. Remove and replace defective Work.
 - 3. Remove and replace Work not conforming to requirements of the Contract Documents.
 - 4. Remove samples of installed Work as specified for testing.
 - 5. Install equipment and materials in existing structures.
 - 6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
- C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.
- D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 - 1. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
 - 2. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION

SECTION 22 0511 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and the Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following basic mechanical materials and methods to complement other Division 22 Sections.
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Concrete equipment base construction requirements.
 - 3. Equipment nameplate data requirements.
 - 4. Labeling and identifying mechanical systems and equipment is specified in Division 22.
 - 5. Nonshrink grout for equipment installations.
 - 6. Field-fabricated metal and wood equipment supports.
 - 7. Installation requirements common to equipment specification Sections.
 - 8. Mechanical demolition.
 - 9. Cutting and patching.
 - 10. Touchup painting and finishing.

1.3 **DEFINITIONS**

- A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.
- B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

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- E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate mechanical equipment installation with other building components.
- B. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.
- D. Coordinate connection of electrical services.
- E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

1.6 WARRANTIES

A. Warranties shall begin at date of substantial completion. All compressors shall include a minimum of five years warranty. One year warranty for labor, parts, units, etc. is required for all equipment. Additionally, Contractor is responsible for all preventative maintenance and routine service on installed equipment for the one year warranty period in order to maintain all factory/manufacturer warranties.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

- A. Refer to individual piping system specification Sections for pipe and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual piping system specification Sections in Division 22 for special joining materials not listed below.
- B. Solder Filler Metal: ASTM B 32.
 - 1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10 percent lead content.
 - 2. Alloy E: Tin (approximately 95 percent) and copper (approximately 5 percent), having 0.10 percent maximum lead content.
 - 3. Alloy HA: Tin-antimony-silver-copper-zinc, having 0.10 percent maximum lead content.
 - 4. Alloy HB: Tin-antimony-silver-copper-nickel, having 0.10 percent maximum lead content.
- C. Brazing Filler Metals: AWS A5.8.
 - 1. BCuP Series: Copper-phosphorus alloys.
 - 2. BAg1: Silver alloy.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Solvent Cements: Manufacturer's standard solvents complying with the following:
 - 1. Chlorinated Poly(Vinyl Chloride) (CPVC): ASTM F 493.
 - 2. Poly(Vinyl Chloride) (PVC): ASTM D 2564.
- F. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.
- G. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end pressure pipes.
 - 1. Sleeve: ASTM A 126, Class B, gray iron.
 - 2. Followers: ASTM A 47 (ASTM A 47M), Grade 32510 or ASTM A 536 ductile iron.
 - 3. Gaskets: Rubber.
 - 4. Bolts and Nuts: AWWA C111.
 - 5. Finish: Enamel paint.

2.3 IDENTIFYING DEVICES AND LABELS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 22 Sections. Where more than one type is specified for listed application, selection is Installer's option, but provide single selection for each product category.
- B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped, permanently fastened to equipment.
 - 1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
 - 2. Location: An accessible and visible location.
- C. Stencils: Standard stencils, prepared for required applications with letter sizes conforming to recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4-inch (30mm) -high letters for ductwork and not less than 3/4-inch (19mm) -high letters for access door signs and similar operational instructions.
 - 1. Material: Brass.
 - 2. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
 - 3. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.
- D. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

2.4 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.50MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory-packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS--COMMON REQUIREMENTS

A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 22 specify piping installation

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requirements unique to the piping system.

- B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.
- C. Install components having pressure rating equal to or greater than system operating pressure.
- D. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- E. Install piping free of sags and bends.
- F. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.
- G. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- H. Install piping to allow application of insulation plus 1-inch (25mm) clearance around insulation.
- I. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- J. Install fittings for changes in direction and branch connections.
- K. Install couplings according to manufacturer's printed instructions.
- L. Sleeves are not required for core drilled holes.
- M. Permanent sleeves are not required for holes formed by PE plastic (removable) sleeves.
- N. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.
 - 2. Install large enough sleeves to provide 1/4-inch (6mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than 6 inches (150 mm).
 - 3. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified in Division 7 Section "Joint Sealants."
- O. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical

sleeve seals. Size sleeve for 1-inch (25mm) annular clear space between pipe and sleeve for installation of mechanical seals.

- 1. Install steel pipe for sleeves smaller than 6 inches (150 mm).
- 2. Install cast-iron wall pipes for sleeves 6 inches (150 mm) and larger.
- 3. Assemble and install mechanical seals according to manufacturer's printed instructions.
- P. Below Grade, Exterior Wall, Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.
- Q. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material. Firestopping materials are specified in Division 7 Section "Firestopping."
- R. Verify final equipment locations for roughing in.
- S. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.
 - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - 3. Soldered Joints: Construct joints according to AWS "Soldering Manual," Chapter 22 "The Soldering of Pipe and Tube."
 - 4. Brazed Joints: Construct joints according to AWS "Brazing Manual" in the "Pipe and Tube" chapter.
 - 5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
 - a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
 - c. Align threads at point of assembly.
 - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- T. Piping Connections: Except as otherwise indicated, make piping connections as specified below.
 - 1. Install unions in piping 2 inches (50 mm) and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch (50mm) or smaller threaded pipe connection.

2. Wet Piping Systems (Water and Steam): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION--COMMON REQUIREMENTS

- A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
- D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
- E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.3 LABELING AND IDENTIFYING

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
 - 1. Stenciled Markers: Complying with ASME A13.1.
- B. Equipment: Install engraved plastic laminate sign or equipment marker on or near each major item of mechanical equipment.
 - 1. Lettering Size: Minimum 1/4-inch (6mm) -high lettering for name of unit where viewing distance is less than 2 feet (0.6 m), 1/2-inch (13mm) -high for distances up to 6 feet (1.8 m), and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.
 - 2. Text of Signs: Provide text to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to name of identified unit.
- C. Adjusting: Relocate identifying devices which become visually blocked by work of this Division or other Divisions.

3.4 PAINTING AND FINISHING

A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 DEMOLITION

- A. Disconnect, demolish, and remove work specified under Division 22 and as indicated.
- B. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
- C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.
- D. Abandoned Work: Cut and remove buried pipe abandoned in place, 2 inches (50 mm) beyond the face of adjacent construction. Cap and patch surface to match existing finish.
- E. Removal: Remove indicated equipment from the Project site.
- F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.6 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.
- B. Repair cut surfaces to match adjacent surfaces.

3.7 GROUTING

- A. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms for placement of grout, as required.
- D. Avoid air entrapment when placing grout.
- E. Place grout to completely fill equipment bases.
- F. Place grout on concrete bases to provide a smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout according to manufacturer's printed instructions.

END OF SECTION

SECTION 23 0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
 - 2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 23 0529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Fiberglass pipe hangers.
 - 4. Metal framing systems.
 - 5. Fiberglass strut systems.
 - 6. Thermal-hanger shield inserts.
 - 7. Fastener systems.
 - 8. Pipe stands.
 - 9. Equipment stands.
 - 10. Equipment supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Environmental Product Declaration (EPD): For each product.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

2.2 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
 - 3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
 - Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Stainless Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- C. Copper Pipe and Tube Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and Ubolts.

2.4 FIBERGLASS PIPE HANGERS

- A. Clevis-Type, Fiberglass Pipe Hangers:
 - 1. Description: Similar to MSS SP-58, Type 1, factory-fabricated steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.

2.5 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 - 1. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 - 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 3. Channels: Continuous slotted carbon-steel channel with inturned lips.
 - 4. Channel Width: Selected for applicable load criteria.
 - 5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.
 - 7. Metallic Coating: No coating.
- B. Non-MFMA Manufacturer Metal Framing Systems:
 - 1. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 - 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 3. Channels: Continuous slotted carbon-steel channel with inturned lips.
 - 4. Channel Width: Select for applicable load criteria.
 - 5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.
 - 7. Metallic Coating: No coating.

2.6 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psi ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

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- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Indoor Applications: Zinc-coated or stainless steel.
 - 2. Outdoor Applications: Stainless steel.

2.8 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand:
 - 1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
 - 2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
 - a. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than percent.
 - 3. Hardware: Galvanized steel or polycarbonate.
 - 4. Accessories: Protection pads.
- C. Low-Profile, Single Base, Single-Pipe Stand:
 - 1. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
 - 2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
 - a. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than Insert value percent.
 - 3. Vertical Members: Two, galvanized-steel, continuous-thread 1/2-inch rods.
 - 4. Horizontal Member: Adjustable horizontal, galvanized-steel pipe support channels.
 - 5. Pipe Supports: Roller.
 - 6. Hardware: Galvanized steel.
 - 7. Accessories: Protection pads.
 - 8. Height: 12 inches above roof.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbonsteel shapes.
2.10 OUTDOOR EQUIPMENT STANDS

- A. Description: Individual foot supports with elevated adjustable channel cross bars and clamps/fasteners/bolts for ground or roof supported outdoor equipment components, without roof membrane penetration, in a pre-fabricated system that can be modularly-assembled on site.
- B. Foot Material: Rubber or polypropylene.
- C. Rails Material: Hot dip galvanized carbon steel.
- D. Wind/Sliding Load Resistance: Up to 150 MPH minimum.

2.11 MATERIALS

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.
- D. Stainless Steel: ASTM A240/A240M.
- E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.
- F. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 7200 "Roof Accessories" for curbs.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Section 09 9113 "Exterior Painting" Section 09 9123 "Interior Painting" and Section 09 9600 "High-Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.
- F. Use stainless steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow offcenter closure for hanger installation before pipe erection.
 - Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 - 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

- 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steelpipe base stanchion support and cast-iron floor flange or carbon-steel plate.
- 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
- Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
- 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
- Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
- Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
- Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
- 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

- 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
- Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
- 6. C-Clamps (MSS Type 23): For structural shapes.
- Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
- 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
- 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel Ibeams for heavy loads.
- 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel Ibeams for heavy loads, with link extensions.
- 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
- 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 - Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 - 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 - 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 - 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 - Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

- 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
- 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.
 - 6. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch, stainless steel, 0.025-inch aluminum, 0.032inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Letter Color: White.

- 3. Background Color: Black.
- 4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- 5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- 6. Fasteners: Stainless-steel rivets or self-tapping screws.
- 7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: Black.
 - 3. Background Color: White.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Red.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- 1. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.4 STENCILS

- A. Stencils for Piping:
 - 1. Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
 - 2. Stencil Material: Brass.
 - 3. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 4. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link chain or beaded chain or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

- A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches minimum.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Safety yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

- A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- D. Pipe Label Color Schedule:
 - 1. Low-Pressure Compressed Air Piping:
 - a. Background: Safety blue.
 - b. Letter Colors: White.
 - 2. High-Pressure Compressed Air Piping:
 - a. Background: Safety blue.
 - b. Letter Colors: White.
 - 3. Domestic Water Piping
 - a. Background: Safety green.
 - b. Letter Colors: White.

- 4. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: Safety black.
 - b. Letter Color: White.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Cold Water: 1-1/2 inches, round.
 - b. Hot Water: 1-1/2 inches, round.
 - c. Low-Pressure Compressed Air: 1-1/2 inches, round.
 - d. High-Pressure Compressed Air: 1-1/2 inches, round.
 - 2. Valve-Tag Colors:
 - a. Cold Water: Natural.
 - b. Hot Water: Natural.
 - c. Low-Pressure Compressed Air: Natural.
 - d. High-Pressure Compressed Air: Natural.
 - 3. Letter Colors:
 - a. Cold Water: White.
 - b. Hot Water: White.
 - c. Low-Pressure Compressed Air: White.
 - d. High-Pressure Compressed Air: White.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

I.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. Related Sections
 - 1. General requirements for testing agencies are specified in the Division-1 Section Quality Control Services.
 - 2. Other Division-23 Sections specify balancing devices and their installation, and materials and installations of mechanical systems.
 - 3. Individual Division-23 system sections specify leak testing requirements and procedures.

I.2 SUMMARY

- A. This Section specifies the requirements and procedures total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
- B. Test, adjust, and balance the following mechanical systems
 - 1. Supply air systems, all pressure ranges; including variable volume and double duct systems.
 - 2. Return air systems.
 - 3. Exhaust air systems.
 - 4. Verify temperature control system operation.
- C. Test systems for proper sound and vibration levels.
- D. This Section does not include:
 - 1. Testing boilers and pressure vessels for compliance with safety codes;
 - 2. Specifications for materials for patching mechanical systems;
 - Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for inaterials and installation requirements.

4. Requirements and procedures for piping and ductwork systems leakage tests.

1.3 DEFINITIONS

- A. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:
 - 1. The balance of air and water distribution;
 - 2. Adjustment of total system to provide design quantities;
 - 3. Electrical measurement;
 - 4. Verification of performance of all equipment and automatic controls;
 - 5. Sound and vibration measurement.
- B. Test: To determine quantitative performance of equipment.
- C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).
- D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.
- E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.
- F. Report forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.
- G. Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.
- H. Main: Duct or pipe containing the system's major or entire fluid flow.
- I. Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.
- J. Branch main: Duct or pipe serving two or more terminals.
- K. Branch: Duct or pipe serving a single terminal.

1.4 SUBMITTALS

- A. Agency Data
 - 1. Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

- B. Engineer and Technicians Data:
 - 1. Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.
- C. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.
- D. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this information in maintenance data specified in Division 1 and mechanical specifications.
- E. Sample Forms: Submit sample forms, if other than those standard forms prepared by the AABC are proposed.
- F. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:
 - 1. Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
 - 2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.
 - 3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:
 - a. General Information and Summary
 - b. Air Systems
 - c. Hydronic Systems
 - d. Temperature Control Systems
 - e. Special Systems
 - f. Sound and Vibration Systems
 - 4. Report Contents: Provide the following minimum information, forms and data:
 - a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the

seal and name address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.

- b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC and NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.
- G. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.5 QUALITY ASSURANCE

A. PRE-QUALIFIED CONTRACTORS FOR THIS ROLE.

- Superior Test & Balance, Inc. (AABC) 1545 Gulf Shores Parkway, PMB #294 Gulf Shores, AL 36542 Tel: 251.317.3088
- Systems Analysis, Inc. (AABC & NEBB) 217 Oxmoor Circle Birmingham, AL 35209 Tel: 205.802.7850
- National True-Test, Inc. (NEBB) 5757 Carrington Lake Parkway Trussville, AL 35173 Tel: 205.681.9050
- Environmental Testing Service, Inc. (NEBB) 150 Highway 216 Montevallo, AL 35115 Tel: (205) 476-8640
- B. Any Test & Balance Contractors not listed above must be requested and approved in writing ten (10) days prior to the bid.
- C. Agency Qualifications
 - 1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
 - 2. An independent testing, adjusting, and balancing agency certified by Associated Air Balance

Council (AABC) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified by AABC as a Test and Balance Engineer.

- D. Codes and Standards:
 - 1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
 - 2. AABC: "National Standards For Total System Balance".
 - 3. ASHRAE: ASHRAE Handbook, 1984 Systems Volume, Chapter 37, Testing, Adjusting, and Balancing.
- E. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.6 PROJECT CONDITIONS

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

1.7 SEQUENCING AND SCHEDULING

A. Test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 5 deg. F wet bulb temperature of maximum summer design condition, and within 10 deg. F dry bulb temperature of minimum winter design condition. Take final temperature readings during seasonal operation.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

- A. Before operating the system, perform these steps:
 - 1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
 - 2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.
 - 3. Compare design to installed equipment and field installations.
 - 4. Walk the system from the system air handling equipment to terminal units to determine

variations of installation from design.

- 5. Check filters for cleanliness.
- 6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
- 7. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
- 8. Determine best locations in main and branch ductwork for most accurate duct traverses.
- 9. Place outlet dampers in the full open position.
- 10. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
- 11. Lubricate all motors and bearings.
- 12. Check fan belt tension.
- 13. Check fan rotation.

3.2 MEASUREMENTS

- A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.
- B. Provide instruments meeting the specifications of the referenced standards.
- C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.
- D. Apply instrument as recommended by the manufacturer.
- E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.
- F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.
- G. Take all reading with the eye at the level of the indicated value to prevent parallax.
- H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

I. Take measurements in the system where best suited to the task.

3.3 PERFORMING TESTING, ADJUSTING, AND BALANCING

- A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.
- B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.
- C. Patch insulation, ductwork, and housings, using materials identical to those removed.
- D. Seal ducts and piping, and test for and repair leaks.
- E. Seal insulation to re-establish integrity of the vapor barrier.
- F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
- G. Test and Balance Contractor shall run systems through all modes of operation and report any deficiencies. Report shall include complete coil performance for all modes of operation including coil entering and leaving db/wb conditions. Report shall also include outside air temperature and humidity at time of test for each operating mode if applicable.
- H. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.4 TESTING FOR SOUND AND VIBRATION

A. Test and adjust mechanical systems for sound and vibration in accordance with the detailed instructions of the referenced standards.

3.5 RECORD AND REPORT DATA

- A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.
- B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

3.6 DEMONSTRATION

A. Training

1. Train the Owner's maintenance personnel on troubleshooting procedures and testing, adjusting,

and balancing procedures. Review with the Owner's personnel, the information contained in the Operating and Maintenance Data specified in Division 1 and mechanical specifications.

2. Schedule training with Owner through the Architect/Engineer with at least 7 days prior notice.

END OF SECTION

SECTION 23 0713 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, exposed return located in unconditioned space.
 - 5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
 - 6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
 - 7. Indoor, concealed oven and warewash exhaust.
 - 8. Indoor, exposed oven and warewash exhaust.
 - 9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 - 10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
 - 11. Outdoor, concealed supply and return.
 - 12. Outdoor, exposed supply and return.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 - 3. Product Data: For coatings, indicating VOC content.
 - 4. Laboratory Test Reports: For coatings, indicating compliance with requirements for lowemitting materials.
 - 5. Product Data: For sealants, indicating VOC content.
 - 6. Laboratory Test Reports: For sealants, indicating compliance with requirements for lowemitting materials.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

- 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
- 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
- 3. Detail application of field-applied jackets.
- 4. Detail application at linkages of control devices.
- D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
 - 1. Sheet Form Insulation Materials: 12 inches square.
 - 2. Sheet Jacket Materials: 12 inches square.
 - 3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 0529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type II for sheet materials.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type II with factory-applied vinyl jacket, Type III with factory-applied FSK jacket, Type III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ or with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in/h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- J. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C534 or ASTM C1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

2.2 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C656, Type II, Grade 6. Tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.
- B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Verify adhesives have a VOC content of 50 g/L or less.
 - 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Verify fiberglass adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Verify adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Verify adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 1. VOC Content: 300 g/L or less.
 - 2. Low-Emitting Materials: Verify mastic coatings comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.
 - 1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
 - 4. Color: White.
- C. Vapor-Retarder Mastic: Solvent based; suitable for indoor use on below ambient services.
 - 1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 - 2. Service Temperature Range: 0 to 180 deg F.
 - 3. Color: White.
- D. Vapor-Retarder Mastic: Solvent based; suitable for outdoor use on below ambient services.
 - 1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 - 2. Service Temperature Range: Minus 50 to plus 220 deg F.
 - 3. Color: White.

- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 - 1. Water-Vapor Permeance: ASTM E96, greater than 1.0 perm at manufacturer's recommended dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 - 1. Verify adhesives have a VOC content of 50 g/L or less.
 - 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
 - 4. Service Temperature Range: 0 to plus 180 deg F.
 - 5. Color: White.

2.6 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: Aluminum.
 - 5. Verify sealant has a VOC content of 420 g/L or less.
 - 6. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: White.
 - 5. Verify sealant has a VOC content of 420 g/L or less.
 - 6. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
 - FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
 - 4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C1136, Type II.
 - 5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E96/E96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.
- B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.10 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Adhesive: As recommended by jacket material manufacturer.
 - 2. Color: White.
- D. Metal Jacket:
 - 1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Factory cut and rolled to size.

- b. Finish and thickness are indicated in field-applied jacket schedules.
- c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
- d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
- 2. Stainless-Steel Jacket: ASTM A167 or ASTM A240/A240M.
 - a. Factory cut and rolled to size.
 - b. Material, finish, and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
- E. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

2.11 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 11.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 6.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 - 1. Width: 2 inches.
 - 2. Thickness: 6 mils.
 - 3. Adhesion: 64 ounces force/inch in width.
 - 4. Elongation: 500 percent.

- 5. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Width: 2 inches.
 - 2. Thickness: 3.7 mils.
 - 3. Adhesion: 100 ounces force/inch in width.
 - 4. Elongation: 5 percent.
 - 5. Tensile Strength: 34 lbf/inch in width.

2.12 SECUREMENTS

- A. Bands:
 - 1. Stainless Steel: ASTM A167 or ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
 - 2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
 - 3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:
 - 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - 2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - 3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inchdiameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - 4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.

- b. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
- c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- 5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inchdiameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
- 6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inchthick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel.

2.13 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A167 or ASTM A240/A240M, Type 304 or Type 316.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

- 1. Verify that systems to be insulated have been tested and are free of defects.
- 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:

- 1. Draw jacket tight and smooth.
- Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
- 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
- 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
- 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.

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- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 - 1. Comply with requirements in Section 07 8413 "Penetration Firestopping."
- E. Insulation Installation at Floor Penetrations:
 - 1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitordischarge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with

insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

- a. Repair punctures, tears, and penetrations with tape or mastic to maintain vaporbarrier seal.
- b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
- 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
- Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
- Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitordischarge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
- a. Repair punctures, tears, and penetrations with tape or mastic to maintain vaporbarrier seal.
- b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
- 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
- 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 - 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 - 2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
 - 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

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3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 07 8413 "Penetration Firestopping."

3.9 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

- 1. Indoor, concealed supply and outdoor air.
- 2. Indoor, exposed supply and outdoor air.
- 3. Indoor, concealed return located in unconditioned space.
- 4. Indoor, exposed return located in unconditioned space.
- 5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
- 6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
- 7. Indoor, concealed oven and warewash exhaust.
- 8. Indoor, exposed oven and warewash exhaust.
- 9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
- 10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
- 11. Outdoor, concealed supply and return.
- 12. Outdoor, exposed supply and return.
- B. Items Not Insulated:
 - 1. Fibrous-glass ducts.
 - 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 3. Factory-insulated flexible ducts.
 - 4. Factory-insulated plenums and casings.
 - 5. Flexible connectors.
 - 6. Vibration-control devices.
 - 7. Factory-insulated access panels and doors.

3.12 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Polyolefin: I inch thick.
- B. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Polyolefin: 1 inch thick.
- C. Concealed, round and flat-oval, outdoor-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Polyolefin: 1 inch thick.
- D. Concealed, round and flat-oval, exhaust-air duct insulation shall be one of the following:

- 1. Flexible Elastomeric: 1 inch thick.
- 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
- 4. Polyolefin: 1 inch thick.
- E. Concealed, rectangular, supply-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Polyolefin: 1 inch thick.
- F. Concealed, rectangular, return-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Polyolefin: 1 inch thick.
- G. Concealed, rectangular, outdoor-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Polyolefin: 1 inch thick.
- H. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Polyolefin: 1 inch thick.
- I. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.
- J. Concealed, supply-air plenum insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Polyolefin: 1 inch thick.
- K. Concealed, return-air plenum insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Polyolefin: 1 inch thick.

- L. Concealed, outdoor-air plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
- M. Concealed, exhaust-air plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
- N. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.
 - 5. Polyolefin: 1 inch thick.
- O. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.
 - 5. Polyolefin: 1 inch thick.
- P. Exposed, round and flat-oval, outdoor-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.
 - 5. Polyolefin: 1 inch thick.
- Q. Exposed, round and flat-oval, exhaust-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.
 - 5. Polyolefin: 1 inch thick.
- R. Exposed, rectangular, supply-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Polyolefin: 1 inch thick.
- S. Exposed, rectangular, return-air duct insulation shall be one of the following:

- 1. Flexible Elastomeric: 1 inch thick.
- 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
- 4. Polyolefin: 1 inch thick.
- T. Exposed, rectangular, outdoor-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Polyolefin: 1 inch thick.
- U. Exposed, rectangular, exhaust-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Polyolefin: 1 inch thick.
- V. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.
- W. Exposed, supply-air plenum insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Polyolefin: 1 inch thick.
- X. Exposed, return-air plenum insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 - 4. Polyolefin: 1 inch thick.
- Y. Exposed, outdoor-air plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
- Z. Exposed, exhaust-air plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

3.13 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

- B. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- C. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- D. Concealed, round and flat-oval, outdoor-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- E. Concealed, rectangular, supply-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- F. Concealed, rectangular, return-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- G. Concealed, supply-air plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. 1.5-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- H. Concealed, return-air plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- I. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.
- J. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- K. Exposed, rectangular, supply-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

- L. Exposed, rectangular, return-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- M. Exposed, supply-air plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- N. Exposed, return-air plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. 1.5-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Concealed:
 - 1. Aluminum, Smooth: 0.020 inch thick.
- D. Ducts and Plenums, Exposed:
 - 1. Aluminum, Smooth: 0.020 inch thick.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Concealed:
 - 1. Aluminum, Smooth: 0.020 inch thick.
- D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 - 1. Aluminum, Smooth: 0.024 inch thick.
- E. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 - 1. Stainless Steel, Type 304 or Type 316, Smooth, with: 0.020 inch thick.

END OF SECTION

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DUCT INSULATION

SECTION 23 0920 - TEMPERATURE CONTROL SYSTEM (TCS) AND FACILITY MANAGEMENT CONTROL SYSTEM (FMCS)

PART 1 - GENERAL

1.1 SUMMARY

A. Existing Network Area Controller (NAC) is connected to customer's intranet and shall be supported by existing Honeywell central server located at Construction and Facility Management Office, AANG Headquarters, Montgomery, Alabama.

1.2 SYSTEM DESCRIPTION

- A. The existing Temperature Control System (TCS) is comprised of a network of interoperable, stand-alone digital controllers communicating via LonMark/LonTaik and/or BACnet communication protocols to a Network Area Controller (NAC). Temperature Control System products shall be manufactured by Honeywell. Equivalent products must be approved in writing by the consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal.
- B. The Existing Facility Management and Control System (FMCS) is comprised of Network Area Controller or Controllers (NAC) within each facility. The NAC connects to the owner's local or wide area network, depending on configuration. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through standard Web browsers, via the Internet and/or local area network. Each NAC shall communicate to LonMark/LonTalk (IDC), BACnet (IBC), MODBUS controllers and other open protocol systems/devices provided under Division 23 or Division 26.
- C. The Existing Facility Management and Control System (FMCS) is based on the Honeywell WEBS-AX Platform Version that is currently operating on the WEB-Supervisor or a newer version of the system incorporating the Niagara FrameworkTM.
- D. The DDC/BMS/EMCS Controls Contractor shall contact the AANG CFMO for the current Honeywell/Niagara BMS software version information before commencing work covered under this contract and specification. The DDC/BMS/EMCS Controls Contractor shall provide all necessary Honeywell/Niagara software licenses and license upgrades for a period of One year from the date of final acceptance of this project. The DDC/BMS/EMCS Controls Contractor shall provide a software license maintenance agreement for the Honeywell software for a period of One year from the date of final acceptance for this project.

1.3 GENERAL

A. All NEW control components shall be compliant with Honeywell/Niagara WEBS-AX and meet the requirements of this specification. Equivalent products must be approved in writing by the consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal. Systems not developed on the Niagara Framework platform are unacceptable.

> 23 0920-1 TEMPERATURE CONTROL SYSTEM (TCS) AND FACILITY MANAGEMENT CONTROL SYSTEM (FMCS)

1.4 SUBMITTAL

A. Eight copies of shop drawings of the components and devices for the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions for all controllers, valves, dampers, sensors, routers, etc. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. A complete written Sequence of Operation shall also be included with the submittal package.

1.5 AGENCY AND CODE APPROVALS

- A. All products of the TCS and FMCS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable.
 - 1. UL-916; Energy Management Systems
 - C-UL listed to Canadian Standards Association C22.2 No. 205-M1983 "signal Equipment"
 - 3. CE
 - 4. FCC, Part 15, Subpart J, Class A Computing Devices

1.6 SOFTWARE LICENSE AGREEMENT

A. The Owner shall agree to the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

PART 2 - MATERIALS

2.1 GENERAL

- A. The existing Temperature Control System (TCS) and Facility Management Control System (FMCS) is comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, printers, network devices, valves, dampers, sensors, and other devices as specified herein. All systems and software within FMCS shall be supported by compliance documentation from the manufacturer.
- B. The installed system shall provide secure password access to all features, functions and data contained in the overall FMCS.
- C. Existing system is to remain in place. Completely interface new equipment to existing system.

23 0920-2 TEMPERATURE CONTROL SYSTEM (TCS) AND FACILITY MANAGEMENT CONTROL SYSTEM (FMCS)

2.2 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

- A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, LonWorks technology, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system.
- B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE[™] Standard 135-2001, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file and a resource file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP,) and/or RS-485 (BACnet MSTP) as specified.
- C. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
- D. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.
- E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.
 - 1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
 - 2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.3 NETWORKS (EXISTING TO REMAIN IN PLACE)

A. The Local Area Network (LAN) shall be a 10/100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.

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B. Local area network minimum physical and media access requirements:

- 1. Ethernet; IEEE standard 802.3
- 2. Cable; 100 Base-T, UTP-8 wire, category 5
- 3. Minimum throughput; 100 Mbps.

2.4 NETWORK ACCESS (EXISTING TO REMAIN IN PLACE)

- A. Remote Access.
 - 1. For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The Owner shall provide a connection to the Internet to enable this access via high speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP.

2.5 NETWORK AREA CONTROLLER (NAC) (EXISTING TO REMAIN IN PLACE)

- A. The existing Network Area Controller (NAC) shall remain in place.
- B. Event Alarm Notification and actions
 - 1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
 - 2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.
 - 3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
 - a. To alarm
 - b. Return to normal
 - c. To fault
 - 4. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
 - 5. Provide timed (schedule) routing of alarms by class, object, group, or node.
 - 6. Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
- C. Control equipment and network failures shall be treated as alarms and annunciated.
- D. Alarms shall be annunciated in any of the following manners as defined by the user:
 - 1. Screen message text

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- 2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
 - a. Day of week
 - b. Time of day
 - c. Recipient
- 3. Pagers via paging services that initiate a page on receipt of email message
- 4. Graphic with flashing alarm object(s)
- 5. Printed message, routed directly to a dedicated alarm printer
- E. The following shall be recorded by the NAC for each alarm (at a minimum):
 - 1. Time and date
 - 2. Location (building, floor, zone, office number, etc.)
 - 3. Equipment (air handler #, accessway, etc.)
 - 4. Acknowledge time, date, and user who issued acknowledgement.
 - 5. Number of occurrences since last acknowledgement.
- F. Alarm actions may be initiated by user defined programmable objects created for that purpose.
- G. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
- H. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.
- I. Provide a "query" feature to allow review of specific alarms by user defined parameters.
- J. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
- K. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

2.6 DATABASE BACKUP AND STORAGE (EXISTING TO REMAIN IN PLACE)

- A. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.
- B. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
- C. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.7 INTEROPERABLE DIGITAL CONTROLLER (IDC)

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- A. Controls shall be Honeywell Spyder[™] microprocessor based Interoperable LonWorks or BACnet Controllers (IDC) or approved equal. Where possible, all Interoperable Digital Controllers shall bear the applicable LonMark[™] or BACnet interoperability logo on each product delivered.
- B. HVAC control shall be accomplished using LonMark[™] based devices where the application has a LonMark profile defined. Where LonMark devices are not available for a particular application, devices based on LonWorks shall be acceptable. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file for the device. Publicly available specifications for the Applications Programming Interface (API) must be provided for each LonWorks / LonMark controller defining the programming or setup of each device. This contractor shall provide all programming, documentation and programming tools necessary to set up and configure the supplied devices per the specified sequences of operation. Where BACnet based devices provide superior functionality for the task, BACnet may be used.
- C. This contractor shall run the communication network trunks to the nearest Network Area Controller (NAC). Coordinate locations of the NAC to ensure that maximum network wiring distances, as specified by the industry standard wiring guidelines, are not exceeded. All communications networks must be installed according to industry standard guidelines and use the appropriate trunk termination and bias devices. All LonWorks and LonMark devices must be supplied using FTT-10A LonWorks communications transceivers. The Network Area Controller (NAC) will provide all scheduling, alarming, trending, and network management for the LonMark / LonWorks based devices.
- D. The IDCs shall communicate with the NAC at a baud rate of not less than 78.8K baud. The IDC shall provide LED indication of communication and controller performance to the technician, without cover removal.
- E. All IDCs shall be fully application programmable and shall at all times maintain their LONMARK certification, if so certified. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
- F. The system architecture shall utilize the capabilities of the IDC's for all critical control functions such that a failure of the Network Area Controller (NAC) will not compromise the operation of the system and shall allow the system to default to an occupied mode of operation.

2.8 GRAPHICAL USER INTERFACE SOFTWARE

- A. Operating System:
 - 1. The GUI shall run on Microsoft Windows 7 Professional or greater.
- B. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge

of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.

- C. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:
 - 1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
 - 2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
 - 3. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
 - 4. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
 - a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - b. Holidays shall be set by using a graphical calendar without requiring any keyboard entry from the operator.
 - 5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
 - 6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.
- D. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:
 - 1. Create, delete or modify control strategies.
 - 2. Add/delete objects to the system.
 - 3. Tune control loops through the adjustment of control loop parameters.
 - 4. Enable or disable control strategies.
 - 5. Generate hard copy records or control strategies on a printer.
 - 6. Select points to be alarmed and define the alarm state.
 - 7. Select points to be trended over a period of time and initiate the recording of values automatically.

2.9 WEB BROWSER CLIENTS

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- A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer[™]. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.
- B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the FMCS, shall not be acceptable.
- C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.
- D. The Web browser client shall support at a minimum, the following functions:
 - 1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
 - 2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
 - HTML programming shall not be required to display system graphics or data on a Web
 page. HTML editing of the Web page shall be allowed if the user desires a specific look
 or format.
 - 4. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
 - 5. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
 - 6. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
 - a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
 - b. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - c. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
 - d. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
 - e. View logs and charts
 - f. View and acknowledge alarms

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g.

- 7. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
- 8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.10 SERVER FUNCTIONS AND HARDWARE

- A. The existing central server, located at the Construction & Facility Management Office, AANG Headquarters, Montgomery, Alabama shall support all Network Area Controllers (NAC) connected to the customer's network whether local or remote.
- B. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, T1 or dial-up connection.
- C. It shall be possible to provide access to all Network Area Controllers via a single connection to the server. In this configuration, each Network Area Controller can be accessed from a remote Graphical User Interface (GUI) or from a standard Web browser (WBI) by connecting to the server.
- D. The server shall provide the following functions, at a minimum:
 - 1. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.
 - 2. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.
 - 3. The server shall include a master clock service for its subsystems and provide time synchronization for all Network Area Controllers (NAC).
 - 4. The server shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.
 - 5. The server shall provide scheduling for all Network Area Controllers and their underlying field control devices.
 - 6. The server shall provide demand limiting that operates across all Network Area Controllers. The server must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.
 - 7. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to Network Area Controllers. Systems not employing this prioritization shall not be accepted.
 - 8. Each Network Area Controller supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.

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- 9. The server shall provide central alarm management for all Network Area Controllers supported by the server. Alarm management shall include:
 - 1. Routing of alarms to display, printer, email and pagers
 - 2. View and acknowledge alarms
 - 3. Query alarm logs based on user-defined parameters
- 10. The server shall provide central management of log data for all Network Area Controllers supported by the server. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:
 - 1. Viewing and printing log data
 - 2. Exporting log data to other software applications
 - 3. Query log data based on user-defined parameters

2.11 SYSTEM PROGRAMMING

- A. The Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.
- B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.
- C. Programming Methods
 - 1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
 - Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
 - 3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy

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TEMPERATURE CONTROL SYSTEM (TCS) AND FACILITY MANAGEMENT CONTROL SYSTEM (FMCS) diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.

- 4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.
- 5. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.12 LonWorks SYSTEM INTEGRATION

- A. The Graphical User Interface software (GUI) shall provide a complete set of integrated LonWorks network management tools for working with LonWorks networks. These tools shall manage a database for all LonWorks devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as "binding". Systems requiring the use of third party LonWorks network management tools shall not be accepted.
- B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.
- C. The network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.
- D. These tools shall provide the ability to "learn" an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.
- E. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system, shall not be accepted.

2.13 BACnet SYSTEM INTEGRATION

- A. The Network Area Controller shall support the integration of device data from BACnet MSTP, and/or BACnet Ethernet/IP control system devices. The connection to the BACnet system shall be via an RS-485, or Ethernet/IP as required by the device.
- B. The FMCS supplier shall provide a BACnet system communications driver. The equipment system vendor that provided the equipment utilizing BACnet shall provide documentation of the system's BACnet interface and shall provide factory support at no charge during system commissioning as required for a successful integration.

2.14 MODBUS SYSTEM INTEGRATION

- A. The Network Area Controller shall support the integration of device data from Modbus RTU, ASCII, or TCP control system devices. The connection to the Modbus system shall be via RS-485, or Ethernet/IP as required by the device.
- B. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the Modbus system data into the FPMS. Objects provided shall include at a minimum:
 - 1. Read/Write Modbus AI Registers
 - 2. Read/Write Modbus AO Registers
 - 3. Read/Write Modbus BI Registers
 - 4. Read/Write Modbus BO Registers
- C. All scheduling, alarming, logging and global supervisory control functions, of the Modbus system devices, shall be performed by the Network Area Controller.
- D. The FMCS supplier shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment utilizing Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning as required for a successful integration.

2.14 OTHER CONTROL SYSTEM HARDWARE

- A. Space Temperature/Humidity Wall Module. Wall Module shall be Honeywell TR-71H communicating Wall Module or equivalent, unless specified otherwise.
 - 1. Wall module shall have an LCD display and user push button controls. Where specified, the wall module shall be installed under a locking cover with UL 916 listing designed for mounting on a standard electrical switch box.
 - 2. Space temperature sensors shall be accurate to plus or minus one F degree.
 - 3. Space humidity sensors shall have a sensing range of 5% to 95%.
 - 4. Where specified, the wall module shall have a relative setpoint adjustment for warmercooler adjustments
 - 5. Where specified, wall module shall also have an after-hours override pushbutton and override indicator.
- B. Low Leakage Automatic Control Dampers. Dampers shall be Honeywell or equivalent. Provide all automatic control dampers not specified to be integral with other equipment.
 - 1. Frames shall be 5 inches wide and of no less than 16-gauge galvanized steel. Inter-blade linkage shall be within the frame and out of the air stream.
 - Blades shall not be over 8 inches wide nor less than 16-gauge galvanized steel triple V type for rigidity.
 - 3. Bearings shall be acetyl, oilite, nylon or ball-bearing with ½ inch diameter plated steel shafts.

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- 4. Dampers shall be suitable for temperature ranges of -40 to 180F.
- 6. All proportional control dampers shall be opposed or parallel blade type as hereinafter specified and all two-position dampers shall be parallel blade types.
- 7. Dampers shall be sized to meet flow requirements of the application. The sheet metal contractor shall furnish and install baffles to fit the damper to duct size. Baffles shall not exceed 6". Dampers with dimensions of 24 inches and less shall be rated for 3,000 fpm velocity and shall withstand a maximum system pressure of 5.0 in. w.c. Dampers with dimensions of 36 inches and less shall be rated for 2,500 fpm velocity and shall withstand a maximum system pressure of 4.0 in. w.c. Dampers with dimensions of 48 inches and less shall be rated for 2,000 fpm velocity and shall withstand a maximum system pressure of 2.5 in. w.c.
- 8. Side seals shall be stainless steel of the tight-seal spring type.
- 9. Dampers shall be minimum leakage type to conserve energy and the temperature control manufacturer shall submit leakage data for all low leakage control dampers with the temperature control submittal.
- 10. Maximum leakage for low leakage dampers in excess of sixteen inches square shall be 8 CFM per square foot at static pressure of 1 inch of WC.
- 11. Low leakage damper blade edges shall be fitted with replaceable, snap-on, inflatable seals to limit damper leakage.
- 12. Testing and ratings shall be in accordance with AMCA Standard 500.
- 13. Damper blade width shall be no greater than 8 inches, and dampers over 48 inches wide by 74 inches high shall be sectionalized. Testing and ratings to be in accordance with AMCA Standard 500.
- 14. Shaft bearings shall be flanged bronze oilite pressed into the frame.
- 15. The blade shall be a minimum 16 gage galvanized steel, and damper frame shall be provided with closed-cell neoprene seals with silicone rubber bead. Damper shall be designed for a 2500 ft/min approach velocity and a 4 inch minimum static pressure.
- C. Duct Mount, Pipe Mount and Outside Air Temperature Sensors: Temperature sensors with an accuracy of <u>+/-</u>0.3° F. Temperature sensors shall be Honeywell or equivalent.
 - 1. Outside air sensors shall include an integral sun shield.
 - 2. Duct sensors shall have sensor approximately in center of the duct, and shall have selectable lengths of 6, 12, and 18 inches.
 - Multipoint averaging element sensors where specified shall have a minimum of one foot of sensor length for each square foot of duct area (provide multiple sensors if necessary).
 - 4. Pipe mount sensors shall have copper, or stainless steel separable wells.
- D. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point shall be provided where specified or required. Current switches shall include an integral LED for indication of trip condition and a current level below trip set point.
 - E. Low Temperature Limit Switches. Limit switches shall be Honeywell or equivalent. Safety low limit shall be manual reset twenty foot limited fill type responsive to the coolest section of its length.
 - F. High Temperature Limit Switches. Limit and Safety switches shall be Honeywell or equivalent. Safety high limit (firestats) shall be manual reset type.

- G. CO2 Sensors. CO2 sensors shall be Honeywell or equivalent.
 - 1. Communicating CO2 sensors shall be Honeywell TR-40/42-CO2 or equilivant.
 - 2. Analog Carbon Dioxide sensors shall be 0-10 VDC output, with corrosion free goldplated non-dispersive infrared sensing, designed for duct or wall mounting.
 - 3. Sensor shall incorporate internal diagnostics for power, sensor, analog output checking, and automatic background calibration algorithm for reduced maintenance. Sensor range shall be 0-2000 PPM with +/- 50 PPM accuracy.
- H. Humidity Sensors. Humidity sensors shall be Honeywell or equivalent.
 - 1. Communicating humidity sensors shall be Honeywell TR-71H or equilivant.
 - Duct, Room and Outdoor analog type sensors shall be 0-10 VDC output and have a sensing range of 5% to 95%.
 - 3. Duct sensors shall be provided with a sampling chamber.
 - 4. Outdoor air humidity sensors shall have a sensing range of 20% to 95% RH. They shall have a compensated ambient temperature range of -40°F to 170° F.
- I. Filter Status Differential Pressure Sensors.
 - 1. Filter Status sensors shall be Dwyer ADPS/EDPS or equivalent.
 - 2. The sensors shall have a dual scaled adjustment knob in inches of water column and Pascals to allow changes to the switching pressure to be made without requiring a pressure gage.
- J. Actuators, General. Actuators shall be Honeywell or equivalent. All automatically controlled devices, unless specified otherwise elsewhere, shall be provided with actuators sized to operate their appropriate loads with sufficient reserve power to provide smooth modulating action or two-position action and tight close-off. Valves shall be provided with actuators suitable for floating or analog signal control as required to match the controller output. Actuators shall be power failure return type where valves or dampers are required to fail to a safe position and where specified.
- K. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. Control panels shall meet all requirements of Title 24, California Administrative Code. All electrical devices within a control panel shall be factory wired. All external wiring shall be connected to terminal strips mounted within the panel. Provide engraved phenolic nameplates identifying panel function on the face of control panels. For control panels powered by dedicated electrical circuits the panel labels shall indicate the electrical panel number and circuit breaker number of the circuit supplying power to the panel. Panel labels shall match ID tags on the As-Built drawings. Panel labels shall be mechanically affixed with stainless screws or pop-rivets. Provide power surge protection for the panel using devices designed and approved for the purpose. A complete set of plastic laminated As-Built control drawings (relating to the controls within that panel) shall be furnished within each control panel.
- L. Water Sub-Meter: (Provided and installed by System Integrator). Existing to remain in place
- M. Gas Sub-Meter: (Provided and installed by System Integrator). The gas sub-meter shall be sized appropriately for the gas supply line size, gas pressure, and capacity. The gas sub-meter selection shall be made in coordination with the utility company. The sub-meter shall include

23 0920-14 TEMPERATURE CONTROL SYSTEM (TCS) AND FACILITY MANAGEMENT CONTROL SYSTEM (FMCS) physical mechanical totalizer index to display gas consumption. The sub-meter shall include a pulse output transmitter for connection to the facility EMCS system. The gas sub-meter pulse output shall be connected to a totalizer input on the facility electrical meter or to an EMCS totalizer input expressly designed to accept pulse inputs for counting and recording consumption data. The gas meter pulser cable shall be installed in seal-tight flex conduit to the fullest extent possible to protect the cable from damage. When run in-ground the pulse signal cable shall be provided with surge protection utilizing devices designed and approved for the purpose. The surge protection shall be located at the totalizer input end of the pulse signal cable.

Approved gas sub-meters and pulser: Elster-American Meter Models: Diaphragm Style Meters: AC Series AL Series Rotary Style Meters: RPM Series RABO Series with integral pulser

Pulser Models: Elster-American RVP (Remote Volume Pulser) IMAC Pulsimatic Transmitter IMAC DMP (Domestic Meter Pulser) is NOT approved.

N. Electrical Sub-Meter: (Provided and installed by System Integrator). Existing to remain in place.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All work described in this section shall be performed by system integrators or contractors that have a successful history in the design and installation of integrated control systems. The installing office shall have a minimum of five years of integration experience and shall provide documentation in the submittal package verifying the company's experience.
- B. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.
- C. Drawings of the TCS and FMCS network are diagrammatic only and any apparatus not shown, but required to make the system operative to the complete satisfaction of the Architect shall be furnished and installed without additional cost.
- D. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by this contractor in accordance with these specifications.
- E. Equipment furnished by the HVAC Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by this contractor.

23 0920-15 TEMPERATURE CONTROL SYSTEM (TCS) AND FACILITY MANAGEMENT CONTROL SYSTEM (FMCS) F. Commissioning Interface (CxGUI): The system shall include a basic WEB based GUI interface programmed into the Network Area Controller (NAC) to be used during system acceptance, commissioning and test and balancing. The CxGUI shall be able to be accessed via direct or network connection to the NAC using a web browser and shall be available to the agents performing the system testing/acceptance. The CxGUI shall display and have access to any and all control points as specified in the project plans and specifications and any other points necessary for system acceptance testing in a graphical grid format. It shall be possible to print or save the results of the acceptance testing to digital files, the data displayed by the CxGUI. These files and printouts shall be included as part of the project closeout documentation.

3.2 WIRING

- A. All electrical control wiring and power wiring to the control panels, NAC, computers and network components shall be the responsibility of the this contractor.
- B. The electrical contractor (Div. 16) shall furnish all power wiring to electrical starters and motors.
- C. All wiring shall be in accordance with the Project Electrical Specifications (Division 16), the National Electrical Code and any applicable local codes. All FMCS wiring shall be installed in the conduit types specified in the Project Electrical Specifications (Division 16) unless otherwise allowed by the National Electrical Code or applicable local codes. Where FMCS plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.
- D. All control cables shall be labeled on each end of the cable with printed labels of either heat-shrink tubing, flags or self-laminating cable wraps. Labels shall match the tag ID's on the As-Built drawings.
- E. All HVAC control devices, new and existing, shall be labeled with approved printed adhesive labels. The labels shall match the ID tags on the As-Built drawings.

3.3 WARRANTY

- A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of final system acceptance.
- B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by this contractor at no expense to the Owner.

3.4 ACCEPTANCE TESTING

A. Upon completion of the installation, this contractor shall load all system software and start-up the system. This contractor shall perform all necessary calibration, testing and de-bugging and

23 0920-16 TEMPERATURE CONTROL SYSTEM (TCS) AND FACILITY MANAGEMENT CONTROL SYSTEM (FMCS) perform all required operational checks to insure that the system is functioning in full accordance with these specifications.

- B. This contractor shall perform tests to verify proper performance of components, routines, and points. Tests shall be repeated until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.
- C. This contractor shall perform QA/QC tests on the LonWorks, BACnet, Modbus and other networks using a digital storage oscilloscope (DSO) to determine proper network operation. These tests shall be documented by printouts and digital files from the DSO.
- D. This contractor shall provide, as part of the closeout documentation, all QA/QC test and verification documentation and logs required by this specification.

3.5 OPERATOR INSTRUCTION, TRAINING

- A. During system commissioning and at such time acceptable performance of the TCS and FMCS hardware and software has been established this contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.
- B. This contractor shall provide 40 hours of instruction to the owner's designated personnel on the operation of the TCS and FMCS and describe its intended use with respect to the programmed functions specified. Operator orientation of the systems shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.

PART 4 - SEQUENCES OF OPERATION

4.1 SUMMARY

A. This contractor shall coordinate control functions, such as scheduling and supervisory level global control, points list, and control sequences needed for this installation as listed below. Contractor shall provide written documentation as required to archive the system operation as accepted by the owner.

END OF SECTION

SECTION 23 0921 - BAS - SYSTEM INTEGRATOR (BAS SI)

PART 1 - GENERAL

1.1 WORK OVERVIEW

- A. This section expands on the project responsibilities described in section 23 0920 CONTROL SYSTEM (TCS) AND FACILITY MANAGEMENT CONTROL SYSTEM (FMCS).
- B. The Integrated Facility Management System (IFMS) is the master interface used by the Alabama Army National Guard (AANG) to access all independent subsystems of automation which may be located in single or multiple buildings, in local or remote sites.
- C. The AANG Server is located in the Construction and Facility Management Office (CFMO) at the AANG Headquarters, Montgomery, Alabama, and its licenses shall be upgraded to handle all systems in this specification.
- D. The AANG Server is a licensed Honeywell WEBSupervisor, licensed to the Alabama National Guard.
- E. Provide all necessary WEBS Controller interface software to integrate the Building Automation System (BAS) to the IFMS Server for common use by local and remote users via web-access.
- F. Provide project management, assistance and expertise in the design of the control system network and system troubleshooting to meet all performance criteria.
- G. Provide necessary hardware and software to interconnect all provided WEBS Controllers, Local Workstations, and other peripherals to the Building Network, and to the AANG Remote Server.
- F. All labor, material patch cords, power supplies, etc., necessary for a complete and operational system shall be provided herein without additional cost to the AANG.
- G. The BAS SI shall provide a native LonWorks and/or BACnet network of controllers for the entire facility. The network of controllers shall include all necessary hardware and software integration interfaces necessary to add to the BAS any system, equipment or field device installed. Items below shall be provided and installed by the Systems Integrator (SI):
 - 1. Lighting Control Systems (LCS) (as applicable to this project)
 - 2. Power Meters, Gas and Water Flow Meters (as applicable to this project) Reference Section 23 0920 for Approved Model Numbers
 - 3. Temperature Control System (TCS) and Facility Management Control Reference Section 23 0920

1.2 QUALIFICATIONS AND EXPERIENCE

- A. The Systems Integrator Contractor (SI) and the Integration Personnel (IP) shall have a documented history in the design, installation and service of LonWorks and BACnet based Control Systems for the HVAC Industry, utilizing Honeywell/Niagara Webs AX or N4 Systems. SI minimum 5 years, IP minimum 2 years.
- B. The SI and IP shall have a successful history implementing a minimum of three (3) projects which are Honeywell/Niagara WEBS AX or N4 systems reporting to a remote AX or N4 Server.
- C. The SI shall be a Honeywell ACI certified contractor.
- D. The controls Integration Personnel (IP) for this project, either direct SI employee(s) or subcontractor(s), are required to have the following certifications:
 - 1. Honeywell/Niagara AX or N4 certification
 - 2. Honeywell Spyder[™] LON programmable controller certification
 - 3. Honeywell Spyder[™] BACnet programmable controller certification
- E. The General Contractor shall submit the SI Qualifications simultaneously with the List of Subcontractors that names the proposed SI.

PART 2 - PRODUCTS AND SERVICES

2.1 PRE-QUALIFIED CONTRACTORS FOR THIS ROLE.

A. Jake Marshall Service, Inc. (JMS) 700 Washington St. Suite 6 or Huntsville, AL 35802 Tel: 256.512.5900 jmservice.com

178 W Valley Ave. Birmingham, AL 35209 Tel: 205.685.1051

B. Walters Controls, Inc. (WCl) 4916 Oak Circle Dr. N. or Mobile, AL 36609 Tel: 251.661.4416 walterscontrols.net

301 Murray RD, STE 1 Dothan, AL 36303 Tel: 251.677.4448 dothan@walterscontrols.net

 C. Southeastern Temperature Controls, Inc. (STC) 320 Applegate Lane Pelham, AL 35124 Tel: 205.685.0103 setempco.com

PART 3 - EXECUTION

3.1 BUILDING CONDITIONS

- A. Examine the job site and building conditions and coordinate the work with A/E, Government representatives and other Contractors.
- B. Contractor shall install the BAS work under the conditions of the project upon commencement of this contract. All vertical risers must occur through sleeves or deck openings. Penetrations shall be kept to a minimum.
- C. Electrical drawings may include dedicated power circuits for BAS use at certain locations inside the building. Contractor is responsible to coordinate additional power requirements for additional panels. Power riser installation from local panels shown in drawings to other controllers or supplemental equipment is responsibility of Contractor.
- D. Contractor shall provide its own tools, office equipment and workstations as required to perform the intended work.
- E. All system interface equipment such as workstations, printers and associated devices as specified in the plans and specifications shall be provided and installed at the final acceptance phase of the project.
- F. BAS hardware, software and system interfaces shall be properly configured and commissioned to facilitate future maintenance and system improvements.

3.2 PRODUCT DELIVERY, STORAGE, HANDLING, PROTECTION AND CLEANING

- A. All products and materials shall be new, clean, and free of defects, damage and corrosion.
- B. Ship and store products and materials in a manner which will protect them from damage, weather, and entry of debris. Do not install damaged items take immediate steps to obtain replacement or repair.
- C. The Contractor shall provide adequate means for and shall fully protect all finish parts of the materials and equipment against damage from any cause during the progress of the work until final acceptance. All materials and equipment in storage and during construction shall be covered in such a manner that no finished surfaces will be damaged or marred, and all moving parts shall be kept clean and dry
- D. Equipment accessories and controls enclosures shall be thoroughly cleaned of cement, dust, dirt, paper, plaster, unused wiring and other installation materials; grease and oil spots shall be removed with cleaning solvent as necessary and surfaces carefully wiped.

3.3 SITE CLEAN UP

A. At conclusion of each day's work, clean up and remove from the site all rubbish, debris and trash accumulated during the day as a result of work of the Contractor. Sidewalks and streets adjoining the property shall be kept broom clean and free of debris, rubbish, trash and obstructions of any kind caused by work of this Contract.

B. Upon completion of the work and at times during progress of the work when requested by A/E or AANG, the Contractor shall remove all surplus materials, rubbish, and debris resulting from the operation, and shall leave the entire building and involved portions of the site, insofar as the work of the Contract is concerned, in neat, clean and acceptable condition.

3.4 EXECUTION AND COORDINATION OF WORK

- A. Examine and compare the referenced drawings and specifications with the specifications and drawings of the other trades and report any discrepancies.
- B. Formal system installation will be authorized once the submittal package is approved in full.
- C. Install and coordinate the BAS work in cooperation with the other trades installing interrelated work. Before installation, make proper provisions to avoid interferences. All changes required in the work of the Contractor, caused by noncompliance with the specifications, shall be made at the Contractor's expense.
- D. Certain LONMARK®, Modbus, BACnet, OPC, and proprietary products, systems and interface devices (i.e. packaged pumping system control panels) may be provided by other trades. Examine the Contract Documents to ascertain the requirements to install, wire, interface, program, and commission these systems. Provide a LONWORK gateway for each product, system or interface device provided with a non-LONMARK communication protocol.
- E. Carefully check and coordinate space requirements with other trades to insure that all material can be installed in the allotted spaces, including areas above finished suspended ceilings.
- F. Installed components shall not interfere with access to other equipment (i.e. coils, valves, access doors and related). Any field equipment, system or panel found to create maintenance difficulties shall be relocated at contractor's expense.
- G. Transmit to other trades information required for work to be provided under their respective Sections in ample time for installation (i.e., communication interface boards, wiring requirements, etc.).
- H. Review approved mechanical submittal packages prior to implementation of control sequences of operation.
- I. Installed components (hardware and software) requiring periodic replacements or maintenance shall allow removal (without damage to other parts or systems or causing shutdown or malfunction).
- J. Wherever work interconnects with work of other trades, coordinate with other trades to insure that all trades have the information necessary so they may properly install ail the necessary connections and equipment. Identify all work items (valves, dampers, etc.) in an accepted manner and notify the responsible trade to install access doors and panels at these locations.
- K. Provide sleeves and conduit for passage of conduit, tubing and wiring through structural masonry, concrete walls and floors, and elsewhere for proper protection of the BAS work.

- L. Coordinate and schedule work with other trades and with CDC's representative in accordance with the construction sequence or schedule.
- M. Locations of panels, equipment, devices, and the like shall accommodate work and prevent interferences. Determine the exact route and location of each pipe, conduit or tubing prior to fabrication.
- N. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example, plumbing drains normally have right-of-way. Lines whose elevations cannot be changed shall have right-of-way over lines whose elevations can be changed.
- O. Offsets, transitions and changes in direction in pipes, conduit, and tubing to shall maintain proper headroom and pitch on sloping lines whether or not indicated on the Drawings.
- P. Install the BAS work to permit removal (without damage to other parts) of other parts requiring periodic replacement or maintenance.
- Q. All safeties and interlocks of mechanical equipment shall be hardware configured to allow these circuits to perform intended functions in AUTO, Manual or By-Pass Modes.
- R. All instruments provided under this contract shall be factory calibrated to minimize QA/QC time. However field calibration and hardware or software adjustments shall be included as needed to meet the functional scope of the AANG HVAC Controls.

3.5 QUALITY ASSURANCE (QA) / QUALITY CONTROL (QC) – INTERNAL COMMISSIONING

- A. GENERAL
 - 1. Definition: Quality Control/Quality Assurance (i.e. internal commissioning) is the process of inspecting system installation while verifying proper operation of hardware devices and software functionalities (operational sequences, graphic panels, monitoring, logging, archiving, alarming, reports, trends, schedules, setpoints, operational nodes, etc...) of all provided and non-provided components that are part of the overall system.
 - 2. The QA/QC test report for each system shall be a modified version of the controller Points Schedules and drawing schematic with deployed sequence. This schedule shall include added columns with check mark boxes for each line item in the point schedule to be filled during the process noted below. This form shall include the dated initials of those resources performing the test(s) and a sign-off space at the end of the document.
 - QA/QC shall coordinate and verify that al provided and non-provided interfaced instruments, devices, hardware & software related with this contract are installed per manufacturer recommendations. Also this individual shall review approved submittals of Interfaced equipment to ensure accuracy of in those documents and field activities related to this project.

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- QA/QC procedures shall be performed before the equipment or system is formally commissioned.
- QA/QC Engineer is responsible to assist project engineer in the installation and verification process to deliver a working system.
- 6. If changes are applied, indicate reason for change on test report.
- If changes are required from other trades, coordinate with GC this change and issue 7. a copy of the report listing the type and cause of failure(s) with required remedial action.
- 8. The QA/QC test report shall be the formal system release for commissioning. CA and designated Government official shall sign-off & date each test report once it is completed.
- After a signed off report is handed to the CA, the Contractor cannot modify any hardware or software portion of the system unless requested by the A/E in writing.

B. CONTROL SYSTEM STATIC CHECK

- Prior to static check of each system attach a copy of approved drawings sheets 1. submitted for this system and applicable sensor calibration sheets or performance reports of specialized devices.
- 2. Operational static check shall include a point to point verification between workstation (software configuration), panel terminations, Controllers terminations, field wiring, field tubing, hardware configuration and sensor calibration of end device.
- 3. Inspect installed sensors and devices. Correct any noted deviations from manufacturers installation instructions. Coordinate field corrections for non-provided equipment. Also verify details such as locations, mounting heights (wall or duct), upstream/downstream distances, tolerances and other special instructions.
- Provide continuity testing between field device wiring to system device where terminated. 4.
- 5. Perform OA/OC tests to on the LonWorks, BACnet, Modbus and other networks using a digital storage oscilloscope (DSO) to demonstrate proper operation of the control networks. These tests shall be documented by printouts and digital files from the DSO.
- Verify point list object configuration details both at the controller and workstation levels. 6.
- 7. Perform the following tests per type of point
 - Digital Input Energize each digital input and verify point response at a. workstation.
 - b. Digital Output - From workstation software override to "ON" each digital output and field verify corresponding final element for proper stroke/status resulting action.

(BAS SI)

- c. Analog Input Provide a standard local reading device and compare field reading with point response at workstation.
- d. Analog Output From workstation software override each Analog Output to values of 0%, 25%, 50% and 100% to field verify corresponding final element for stroke/status resulting action.
- e. Software Inputs Provide a standard local reading device and compare field reading with point response at workstation.
- f. Software Outputs From workstation software override these points following the digital and analog output instructions above.
- g. Setpoints Modify the value and review the system response both at the workstation and node,
- 8. Provide all test, verification and QA/QC documentation required by this specification as part of the project closeout documentation.

C. CONTROL SYSTEM DYNAMIC CHECK

- 1. Operational dynamic check shall include verification that control system, including sensors and actuated devices performs as specified while interconnected to the process.
- 2. Operate each controlled or monitored system in manual mode by simulating the expected sequences and then in automatic mode by testing live sequences.
- 3. Perform control loop tuning, document and implement any modifications required to achieve the end result.
- 4. Confirm modifiable parameters by performing tests and verifying change in status at appropriate Workstation.
- 5. Simulate and test for system failures, manual operation, power failure and load shedding sequences for all systems. Verify warnings, alarms and fail to start logic.
- 6. Verify and demonstrate that Workstation(s) interface graphic panel screens are displayed within a maximum of 3 second time delay and consistent with contract drawings. Verify that each object (hardware and software) on every graphic screen is the same object defined in the system.
- 7. Verify and demonstrate that Workstation(s) interface graphic panel screens are displayed within a maximum of 3 second time delay and consistent with contract drawings. Verify that each object (hardware and software) on every graphic screen is the same object defined in the system.
- D. ALARMS Test via field simulation those points (hardware and software) identified in the Points Schedule for alarm. Silence and acknowledge such alarms to verify system response. Filter and correct all repeatable alarms to insure a nuisance free system. The system must be delivered alarm-free. Those systems with deficiencies shall have their alarms disabled until said deficiencies are corrected.
- E. Reports Test via software simulation standard and custom reports requested for this

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project. Provide a sample of said report both in paper copy and in electronic format.

- F. TRENDS, TOTALIZATION AND HISTORICAL DATA ARCHIVING Contractor shall demonstrate that all control sequences function as specified and the performance of each control loop is within specified limits. Record and print graphical logs for each control loop to verify loop stability is within specified performance limits. Each trend shall be integrated for duration of no less than 12 hours.
- G. Follow Section for 23 0920 for CONTROL SYSTEM (TCS) AND FACILITY MANAGEMENT CONTROL SYSTEM (FMCS) requirements.

3.6 SYSTEM TEST AND BALANCING AND COMMISSIONING REQUIREMENTS

- A. Contractor shall provide a full time field engineer to assist the Test and Balancing Contractor (TAB) and Commissioning Agent(s) to perform their intended duties.
- B. This field engineer shall be equipped with portable laptop, tools and other instruments required to review, verify and command system points as needed by TAB contractor and Commissioning Agent(s).
- C. Field coordinate TAB, Commissioning Agent and Owner's Representative's assistance requirements to allow field engineer to be available during formal system testing and balancing and commissioning efforts.

END OF SECTION

SECTION 23 0993.11 - SEQUENCE OF OPERATIONS FOR HVAC DDC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes control sequences for DDC for HVAC systems, subsystems, and equipment.
- B. Related Requirements:
 - Section 23 0920 "Temperature Control System (TCS) And Facility Management Control System (FMCS)".
 - 2. Section 23 0921 "BAS System Integrator (BAS SI)".

1.3 DEFINITIONS

- A. Analog Output: Proportional output signal (zero- to 10-V dc, 4 to 20 mA).
- B. Binary Output: On/off output signal or contact closure.
- C. DDC: Direct digital control.
- D. Digital Output: Data output that must be interpreted digitally.

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. An instrumentation list for each controlled system. Label each element of the controlled system in table format. Show, in the table element name, type of device, manufacturer, model number, and control device product data sheet number.
 - 2. A complete description of the operation of the control system, including sequences of operation. Include and reference a schematic diagram of the controlled system.
- B. Shop Drawings:
 - 1. Riser diagrams showing control network layout, communication protocol, and wire types.
 - 2. Schematic diagram of each controlled system. Include all control points labeled with point names shown or listed. Show the location of control elements in the system.

3. Wiring diagram for each controlled system. Show all control elements labels. Where a control element is the same as that shown on the control system schematic, label with the same name. Label all terminals.

1.5 EXHAUST FAN - ON/OFF (EF-4)

- A. Run Conditions Interlocked: The fan(s) EF --- shall be interlocked to run when called by space thermostat and runs unless shutdown on safeties.
- B. Fan: The fan shall have a user definable (adj.) minimum runtime.
- C. Fan Status: The controller shall monitor the fan status and space temperature.
- D. Alarms shall be provided as follows:
 - 1. Fan Failure: Commanded on, but the status is off.
 - 2. Fan in Hand: Commanded off, but the status is on.
 - 3. Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

1.6 EXHAUST FAN - ON/OFF (VEF-1 and VEF-2)

- A. Run Conditions Interlocked: The fan(s) EF --- shall be interlocked to run whenever space wall switch is "on" and runs unless shutdown on safeties.
- B. Fan: The fan shall have a user definable (adj.) minimum runtime.
- C. Fan Status: The controller shall monitor the fan status.
- D. Alarms shall be provided as follows:
 - 1. Fan Failure: Commanded on, but the status is off.
 - 2. Fan in Hand: Commanded off, but the status is on.
 - 3. Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

1.7 EXHAUST FAN - ON/OFF (EF-8)

- A. Run Conditions Interlocked: The fan(s) EF --- shall be interlocked to run whenever space lighting is "on". Fan shall also be interlocked with battery charging system and runs unless shut-down on safeties.
- B. Fan: The fan shall have a user definable (adj.) minimum runtime.
- C. Fan Status: The controller shall monitor the fan status.
- D. Alarms shall be provided as follows:
 - 1. Fan Failure: Commanded on, but the status is off.
 - 2. Fan in Hand: Commanded off, but the status is on.
3. Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

1.8 OUTSIDE AIR CONDITIONS (TYPICAL OF 1 PER BUILDING)

- A. Outside Air Conditions: The controller shall monitor the outside air temperature and humidity and calculate the outside air enthalpy on a continual basis. These values shall be made available to the system at all times.
 - 1. Alarm shall be generated as follows:
 - a. Sensor Failure: Sensor reading indicates shorted or disconnected sensor. In the event of a sensor failure, an alternate outside air conditions sensor shall be made available to the system without interruption in sensor readings.
- B. If an OA Temp Sensor cannot be read, a default value of 65°F will be used.
- C. If an OA Humidity Sensor cannot be read, a default value of 70% will be used.
- D. Outside Air Temperature History: The controller shall monitor and record the high and low temperature readings for the outside air. These readings shall be recorded on a daily, month-to-date, and year-to-date basis.
 - 1. Cooling Degree Day: The controller shall provide a Degree Day history index that reflects the energy consumption for the facilities cooling demand. Computations shall use a mean daily temperature of 65°F (adj.). The Degree Day peak value readings shall be recorded on a daily, month-to-date, and year-to-date basis.
 - 2. Heating Degree Day: The controller shall provide a Degree Day history index that reflects the energy consumption for the facilities heating demand. Computations shall use a mean daily temperature of 65°F (adj.). The Degree Day peak value readings shall be recorded on a daily, month-to-date, and year-to-date basis.

1.9 GAS INFRARED HEATERS

- A. Sequence: The system shall operate to maintain space temperature at set point as sensed by wall mounted temperature set point module and black bulb sensor. On a call for heating, the gas heat shall cycle to maintain heating set point.
- B. Run Conditions Scheduled:
 - 1. The unit shall run according to a user definable time schedule in the following modes:
 - a. Occupied Mode: The unit shall maintain
 - 65°F (adj.) heating setpoint.
 - b. Unoccupied Mode (night setback): The unit shall maintain
 - 1) A 55°F (adj.) heating setpoint.

- C. Zone Setpoint Adjust: The occupant shall be able to adjust the zone temperature setpoints at the zone sensor.
- D. Zone Unoccupied Override: A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.
- E. Alarms shall be provided as follows:
 - 1. Unit Failure: Commanded on, but the status is off.
 - 2. Unit in Hand: Commanded off, but the status is on.
- F. Discharge Air Temperature: The controller shall monitor the discharge air temperature.
 - 1. Alarms shall be provided as follows:
 - a. High Discharge Air Temp: If the discharge air temperature is greater than 120°F (adj.).
 - b. Low Discharge Air Temp: If the discharge air temperature is less than 40°F (adj.).

1.9 CEILING MOUNTED ELECTRIC HEATER

- B. Sequence: The system shall operate to maintain space temperature at set point as sensed by wall mounted temperature set point module. On a call for heating, the heat shall cycle to maintain heating set point.
- B. Run Conditions Scheduled:
 - 1. The unit shall run according to a user definable time schedule in the following modes:
 - a. Occupied Mode: The unit shall maintain
 1) 65°F (adj.) heating setpoint.
 - b. Unoccupied Mode (night setback): The unit shall maintain
 2) A 55°F (adj.) heating setpoint.
- C. Zone Setpoint Adjust: The occupant shall be able to adjust the zone temperature setpoints at the zone sensor.
- D. Zone Unoccupied Override: A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.
- E. Alarms shall be provided as follows:
 - 3. Unit Failure: Commanded on, but the status is off.
 - 4. Unit in Hand: Commanded off, but the status is on.

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PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 23 2300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Suction Lines for Heat-Pump Applications: 535 psig.
 - 3. Hot-Gas and Liquid Lines: 535 psig.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
 - 1. Thermostatic expansion valves.
 - 2. Solenoid valves.
 - 3. Hot-gas bypass valves.
 - 4. Filter dryers.
 - 5. Strainers.
 - 6. Pressure-regulating valves.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
 - 1. Shop Drawing Scale: 1/4 inch equals 1 foot.
 - 2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.8 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.9 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07720 "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K or L ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.
- F. Flexible Connectors:

- 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
- 2. End Connections: Socket ends.
- 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
- 4. Pressure Rating: Factory test at minimum 500 psig.
- 5. Maximum Operating Temperature: 250 deg F.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; Type, Grade, and wall thickness as selected in Part 3 piping applications articles.
- B. Wrought-Steel Fittings: ASTM A 234/A 234M, for welded joints.
- C. Steel Flanges and Flanged Fittings: ASME B16.5, steel, including bolts, nuts, and gaskets, bevelwelded end connection, and raised face.
- D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Flanged Unions:
 - 1. Body: Forged-steel flanges for NPS 1 to NPS 1-1/2 and ductile iron for NPS 2 to NPS 3. Apply rust-resistant finish at factory.
 - 2. Gasket: Fiber asbestos free.
 - 3. Fasteners: Four plated-steel bolts, with silicon bronze nuts. Apply rust-resistant finish at factory.
 - 4. End Connections: Brass tailpiece adapters for solder-end connections to copper tubing.
 - 5. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
 - 6. Pressure Rating: Factory test at minimum 400 psig.
 - 7. Maximum Operating Temperature: 330 deg F.
- F. Flexible Connectors:
 - 1. Body: Stainless-steel bellows with woven, flexible, stainless-steel-wire-reinforced protective jacket
 - 2. End Connections:
 - a. NPS 2 and Smaller: With threaded-end connections.
 - b. NPS 2-1/2 and Larger: With flanged-end connections.
 - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
 - 4. Pressure Rating: Factory test at minimum 500 psig.
 - 5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
 - 1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
 - 2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
 - 3. Operator: Rising stem and hand wheel.
 - 4. Seat: Nylon.
 - 5. End Connections: Socket, union, or flanged.
 - 6. Working Pressure Rating: 500 psig.
 - 7. Maximum Operating Temperature: 275 deg F.
- B. Packed-Angle Valves:
 - 1. Body and Bonnet: Forged brass or cast bronze.
 - 2. Packing: Molded stem, back seating, and replaceable under pressure.
 - 3. Operator: Rising stem.
 - 4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
 - 5. Seal Cap: Forged-brass or valox hex cap.
 - 6. End Connections: Socket, union, threaded, or flanged.
 - 7. Working Pressure Rating: 500 psig.
 - 8. Maximum Operating Temperature: 275 deg F.
- C. Check Valves:
 - 1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
 - 2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
 - 3. Piston: Removable polytetrafluoroethylene seat.
 - 4. Closing Spring: Stainless steel.
 - 5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
 - 6. End Connections: Socket, union, threaded, or flanged.
 - 7. Maximum Opening Pressure: 0.50 psig.
 - 8. Working Pressure Rating: 500 psig.
 - 9. Maximum Operating Temperature: 275 deg F.
- D. Service Valves:
 - 1. Body: Forged brass with brass cap including key end to remove core.
 - 2. Core: Removable ball-type check valve with stainless-steel spring.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Copper spring.
 - 5. Working Pressure Rating: 500 psig.
- E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
 - 1. Body and Bonnet: Plated steel.
 - 2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Threaded.

- 5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and ac coil.
- 6. Working Pressure Rating: 400 psig.
- 7. Maximum Operating Temperature: 240 deg F.
- 8. Manual operator.
- F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
 - 1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
 - 2. Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Seat Disc: Polytetrafluoroethylene.
 - 4. End Connections: Threaded.
 - 5. Working Pressure Rating: 400 psig.
 - 6. Maximum Operating Temperature: 240 deg F.
- G. Thermostatic Expansion Valves: Comply with ARI 750.
 - 1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 - 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Packing and Gaskets: Non-asbestos.
 - 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 - 5. Suction Temperature: 40 deg F.
 - 6. Superheat: Adjustable.
 - 7. Reverse-flow option (for heat-pump applications).
 - 8. End Connections: Socket, flare, or threaded union.
 - 9. Working Pressure Rating: 700 psig.
- H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
 - 1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
 - 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Packing and Gaskets: Non-asbestos.
 - 4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 - 5. Seat: Polytetrafluoroethylene.
 - 6. Equalizer: Internal.
 - 7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and ac coil.
 - 8. End Connections: Socket.
 - 9. Throttling Range: Maximum 5 psig.
 - 10. Working Pressure Rating: 500 psig.
 - 11. Maximum Operating Temperature: 240 deg F.
- 1. Straight-Type Strainers:
 - 1. Body: Welded steel with corrosion-resistant coating.
 - 2. Screen: 100-mesh stainless steel.
 - 3. End Connections: Socket or flare.
 - 4. Working Pressure Rating: 500 psig.
 - 5. Maximum Operating Temperature: 275 deg F.

- J. Angle-Type Strainers:
 - 1. Body: Forged brass or cast bronze.
 - 2. Drain Plug: Brass hex plug.
 - 3. Screen: 100-mesh monel.
 - 4. End Connections: Socket or flare.
 - 5. Working Pressure Rating: 500 psig.
 - 6. Maximum Operating Temperature: 275 deg F.
- K. Moisture/Liquid Indicators:
 - 1. Body: Forged brass.
 - 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 - 3. Indicator: Color coded to show moisture content in ppm.
 - 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 - 5. End Connections: Socket or flare.
 - 6. Working Pressure Rating: 500 psig.
 - 7. Maximum Operating Temperature: 240 deg F.
- L. Replaceable-Core Filter Dryers: Comply with ARI 730.
 - 1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
 - 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 - 3. Desiccant Media: Activated alumina.
 - 4. Designed for reverse flow (for heat-pump applications).
 - 5. End Connections: Socket.
 - 6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
 - 7. Maximum Pressure Loss: 2 psig.
 - 8. Rated Flow: Based upon HVAC tons of refrigeration.
 - 9. Working Pressure Rating: 500 psig.
 - 10. Maximum Operating Temperature: 240 deg F.
- M. Permanent Filter Dryers: Comply with ARI 730,
 - 1. Body and Cover: Painted-steel shell.
 - 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 - 3. Desiccant Media: Activated alumina.
 - 4. Designed for reverse flow (for heat-pump applications).
 - 5. End Connections: Socket.
 - 6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
 - 7. Maximum Pressure Loss: 2 psig.
 - 8. Rated Flow: Based upon HVAC tons of refrigeration.
 - 9. Working Pressure Rating: 500 psig.
 - 10. Maximum Operating Temperature: 240 deg F.
- N. Mufflers:

- 1. Body: Welded steel with corrosion-resistant coating.
- 2. End Connections: Socket or flare.
- 3. Working Pressure Rating: 500 psig.
- 4. Maximum Operating Temperature: 275 deg F.
- O. Receivers: Comply with ARI 495.
 - 1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
 - 2. Comply with UL 207; listed and labeled by an NRTL.
 - 3. Body: Welded steel with corrosion-resistant coating.
 - 4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
 - 5. End Connections: Socket or threaded.
 - 6. Working Pressure Rating: 500 psig.
 - 7. Maximum Operating Temperature: 275 deg F.
- P. Liquid Accumulators: Comply with ARI 495.
 - 1. Body: Welded steel with corrosion-resistant coating.
 - 2. End Connections: Socket or threaded.
 - 3. Working Pressure Rating: 500 psig.
 - 4. Maximum Operating Temperature: 275 deg F.

2.4 REFRIGERANTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. <u>Manufacturers</u>: Subject to compliance with requirements, provide products by one of the following:
 - 1. Atofina Chemicals, Inc.
 - 2. DuPont Company; Fluorochemicals Div.
 - 3. Honeywell, Inc.; Genetron Refrigerants.
 - 4. INEOS Fluor Americas LLC.
- C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
- B. Suction Lines NPS 3-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

- C. Suction Lines NPS 4 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.
- D. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- E. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:
 - 1. NPS 5/8 and Smaller: Copper, Type ACR, annealed- or drawn-temper tubing and wroughtcopper fittings with brazed or soldered joints.
 - 2. NPS 3/4 to NPS 1 and Smaller: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
 - 3. NPS 1-1/4 and Smaller: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
 - 4. NPS 1-1/2 to NPS 2: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
- F. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications NPS 2 to NPS 4: Schedule 40, black-steel and wrought-steel fittings with welded joints.
- G. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- H. Safety-Relief-Valve Discharge Piping: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- I. Safety-Relief-Valve Discharge Piping:
 - 1. NPS 5/8 and Smaller: Copper, Type ACR, annealed- or drawn-temper tubing and wroughtcopper fittings with brazed or soldered joints.
 - 2. NPS 3/4 to NPS 1 and Smaller: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
 - 3. NPS 1-1/4 and Smaller: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
 - 4. NPS 1-1/2 to NPS 2: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
- J. Safety-Relief-Valve Discharge Piping NPS 2 to NPS 4: Schedule 40, black-steel and wroughtsteel fittings with welded joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

- B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.
- E. Install a full-sized, three-valve bypass around filter dryers.
- F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
- G. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 - 1. Install valve so diaphragm case is warmer than bulb.
 - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 - 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
 - 1. Solenoid valves.
 - 2. Thermostatic expansion valves.
 - 3. Hot-gas bypass valves.
 - 4. Compressor.
- K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.
- L. Install receivers sized to accommodate pump-down charge,
- M. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to drawings and specifications for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 08311 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in protective conduit where installed belowground.
- N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- O. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- Q. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:
 - 1. Shot blast the interior of piping.

- 2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
- 3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
- 4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
- 5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
- 6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.
- R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- S. Identify refrigerant piping and valves according to specifications.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified.
- U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified.
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified.

3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.
- F. Threaded Joints: Thread steel pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

- G. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.
- H. Welded Joints: Construct joints according to AWS D10.12/D10.12M.
- I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
 - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - 9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - 2. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
 - 3. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
 - 4. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.
- E. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:

- 1. Comply with ASME B31.5, Chapter VI.
- 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
- 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
 - 1. Install core in filter dryers after leak test but before evacuation.
 - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 - 4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - 1. Open shutoff valves in condenser water circuit.
 - 2. Verify that compressor oil level is correct.
 - 3. Open compressor suction and discharge valves.
 - 4. Open refrigerant valves except bypass valves that are used for other purposes.
 - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

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SECTION 23 3113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Single-wall rectangular ducts and fittings.
 - 2. Double-wall rectangular ducts and fittings.
 - 3. Single-wall round ducts and fittings.
 - 4. Double-wall round ducts and fittings.
 - 5. Sheet metal materials.
 - 6. Duct liner.
 - 7. Sealants and gaskets.
 - 8. Hangers and supports.
 - 9. Seismic-restraint devices.
- B. Related Sections:
 - 1. Section 23 0593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
 - 2. Section 23 3116 "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
 - 3. Section 23 3300 "Air Duct Accessories" for dampers, sound-control devices, ductmounting access doors and panels, turning vanes, and flexible ducts.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Liners and adhesives.
 - 2. Sealants and gaskets.
 - 3. Seismic-restraint devices.
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 - 3. Product Data: For sealants, indicating VOC content.

- 4. Laboratory Test Reports: For sealants, indicating compliance with requirements for lowemitting materials.
- 5. Laboratory Test Reports: For antimicrobial coatings, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Factory- and shop-fabricated ducts and fittings.
 - 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - 4. Elevation of top and bottom of ducts.
 - 5. Dimensions of main all duct runs from building grid lines.
 - 6. Fittings.
 - 7. Reinforcement and spacing.
 - 8. Seam and joint construction.
 - 9. Penetrations through fire-rated and other partitions.
 - 10. Equipment installation based on equipment being used on Project.
 - 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 - 12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. Welding certificates.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel," for hangers and supports.
 - 2. AWS D1.2/D1.2M, "Structural Welding Code Aluminum," for aluminum supports.
 - 3. A WS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment," and Section 7 "Construction and System Startup."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 -"HVAC System Construction and Insulation."
- D. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
 - 2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
- B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for staticpressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
 - For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
 - 3. Where specified for specific applications, all joints shall be welded.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
 - 1. Where specified for specific applications, all joints shall be welded.
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Rectangular Ducts: Fabricate ducts with indicated dimensions for clear internal dimensions of the inner duct.

- B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
 - 2. For ducts exposed to weather, construct outer duct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
- C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, ductsupport intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards -Metal and Flexible."
 - 1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
 - For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
 - 3. Where specified for specific applications, all joints shall be welded.
- D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, ductsupport intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards -Metal and Flexible."
 - 1. Where specified for specific applications, all joints shall be welded.
- E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - 3. Coat insulation with antimicrobial coating.
 - 4. Cover insulation with polyester film complying with UL 181, Class 1.
- F. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C534/C534M, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
 - 1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2.4 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

- 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
- 2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
- B. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, ductsupport intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards -Metal and Flexible."
 - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with buttwelded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.5 DOUBLE-WALL ROUND DUCTS AND FITTINGS

- A. Round: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.
 - 1. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
 - a. Construct ducts of galvanized sheet steel unless otherwise indicated.
 - b. For ducts exposed to weather, construct outer duct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
 - 2. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

- 3. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- 4. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- B. Inner Duct: solid galvanized sheet steel.
- C. Interstitial Insulation: Fibrous-glass liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - 3. Coat insulation with antimicrobial coating.
 - 4. Cover insulation with polyester film complying with UL 181, Class 1.
- D. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C534/C534M, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
 - 1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2.6 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G60.

- D. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.
- E. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.
- F. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- G. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- H. Tie Rods: Galvanized steel, 1/4-inch-minimum diameter for lengths 36 inches or less; 3/8-inchminimum diameter for lengths longer than 36 inches.

2.7 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity:
 - a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 - 3. Solvent-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.
 - a. Adhesive shall have a VOC content of 80 g/L or less.
 - b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C534/C534M, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
 - 1. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
 - 2. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

- a. Adhesive shall have a VOC content of 80 g/L or less.
- b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Fiberglass-Free Duct Liner: Made from partially recycled cotton or polyester products and containing no fiberglass. Airstream surface overlaid with fire-resistant facing to prevent surface erosion by airstream, complying with NFPA 90A or NFPA 90B. Treat natural-fiber products with antimicrobial coating.
 - 1. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature when tested in accordance with ASTM C518.
 - 2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with ASTM E84; certified by an NRTL.
 - 3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - a. Adhesive shall have a VOC content of 80 g/L or less.
 - b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Insulation Pins and Washers:
 - 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick aluminum; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches in diameter.
- E. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
 - 1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 - Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 - 3. Butt transverse joints without gaps, and coat joint with adhesive.
 - Fold and compress liner in corners of rectangular ducts or cut and fit to ensure buttededge overlapping.
 - 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 - 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpmor greater.

- 7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
- 8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
- 9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
- 10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.8 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - 2. Tape Width: 6 inches.
 - 3. Sealant: Modified styrene acrylic.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
 - 7. Service: Indoor and outdoor.
 - 8. Service Temperature: Minus 40 to plus 200 deg F.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 - 10. Sealant shall have a VOC content of 420 g/L or less.
 - 11. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- C. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Shore A Hardness: Minimum 20.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. VOC: Maximum 75 g/L (less water).
 - 7. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
 - 8. Service: Indoor or outdoor.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Solvent-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Base: Synthetic rubber resin.
 - 3. Solvent: Toluene and heptane.
 - 4. Solids Content: Minimum 60 percent.
 - 5. Shore A Hardness: Minimum 60.
 - 6. Water resistant.
 - 7. Mold and mildew resistant.
 - 8. Sealant shall have a VOC content of 420 g/L or less.
 - 9. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
 - 11. Service: Indoor or outdoor.
 - 12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. Flanged Joint Sealant: Comply with ASTM C920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.
 - Grade: NS.
 - 4. Class: 25.
 - 5. Use: O.
 - 6. Sealant shall have a VOC content of 420 g/L or less.
 - Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- G. Round Duct Joint O-Ring Seals:

- 1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
- 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
- 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.9 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A492.
- F. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.10 SEISMIC-RESTRAINT DEVICES

- A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service.
 - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- B. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- C. Restraint Cables: ASTM A603, galvanized or ASTM A492, stainless-steel cables with end connections made of galvanized-steel assemblies with brackets, swivel, and bolts designed for

restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

- D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested in accordance with ASTM E488/E488M.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 23 3300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.

- K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
- M. Elbows: Use long-radius elbows wherever they fit.
 - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
 - 2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.
- N. Branch Connections: Use lateral or conical branch connections.

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR TYPE 1 COMMERCIAL KITCHEN GREASE HOOD EXHAUST DUCT

- A. Install ducts in accordance with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operation"; SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; and SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines" unless otherwise indicated.
- B. Install all ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.
- C. All joints shall be welded and shall be telescoping, bell, or flange joint as per NFPA 96.
- D. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings.

E. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 ADDITIONAL INSTALLATION REQUIREMENTS FOR EXHAUST DUCTS SERVING COMMERCIAL DISHWASHERS AND OTHER HIGH-HUMIDITY LOCATIONS

- A. Install dishwasher exhaust ducts and other exhaust ducts from wet, high-humidity locations without dips and traps that may hold water. Slope ducts a minimum of 2 percent back to dishwasher or toward drain.
- B. Provide a drain pocket at each low point and at the base of each riser with a 1-inchtrapped copper drain from each drain pocket to open site floor drain.
- C. Minimize number of transverse seams.
- D. Do not locate longitudinal seams on bottom of duct.

3.5 DUCTWORK EXPOSED TO WEATHER

- A. All external joints are to be welded have secure watertight mechanical connections. Seal all openings to provide weatherproof construction.
- B. Construct ductwork to resist external loads of wind, snow, ice, and other effects of weather. Provide necessary supporting structures.
- C. Single Wall:
 - 1. Ductwork shall be Type 304 stainless steel.
 - a. If duct outer surface is uninsulated, protect outer surface with suitable paint. Paint materials and application requirements are specified in Section 09 9113 "Exterior Painting."
 - 2. Where ducts have external insulation, provide weatherproof aluminum jacket. See Section 23 0713 "Duct Insulation."
- D. Double Wall:
 - 1. Ductwork shall comply with requirements in "Double-Wall Rectangular Ducts and Fittings" or "Double-Wall Round Ducts and Fittings" Article.
 - 2. Ductwork outer wall shall be Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
 - 3. Provide interstitial insulation.

3.6 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class C.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 12. Conditioned Space, Retum-Air Ducts: Seal Class C.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.

- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.8 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 23 3300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.9 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:
 - a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
 - b. Supply Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - c. Return Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - d. Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - e. Outdoor-Air Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.

- 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
- 4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
- 5. Test for leaks before applying external insulation.
- 6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
- 7. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.
 - Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.11 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. For cleaning of existing ductwork, see Section 23 0130.52 "Existing HVAC Air Distribution System Cleaning."
- C. Use duct cleaning methodology as indicated in NADCA ACR.
- D. Use service openings for entry and inspection.
 - 1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 23 3300 "Air Duct Accessories" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- E. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

- 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- F. Clean the following components by removing surface contaminants and deposits:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - 4. Coils and related components.
 - 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 - 6. Supply-air ducts, dampers, actuators, and turning vanes.
 - 7. Dedicated exhaust and ventilation components and makeup air systems.
- G. Mechanical Cleaning Methodology:
 - 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 - 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
 - 5. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
 - 6. Provide drainage and cleanup for wash-down procedures.
 - Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.12 STARTUP

A. Air Balance: Comply with requirements in Section 23 0593 "Testing, Adjusting, and Balancing for HVAC."

3.13 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
- 1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
- B. Supply Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
 - 2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
 - 3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
 - a. Pressure Class: Positive 3-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
 - 4. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
- C. Return Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 1-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
 - 2. Ducts Connected to Air-Handling Units Insert equipment:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
 - 3. Ducts Connected to Equipment Not Listed above:

- a. Pressure Class: Positive or negative 2-inch wg.
- b. Minimum SMACNA Seal Class: A.
- c. SMACNA Leakage Class for Rectangular: 2.
- d. SMACNA Leakage Class for Round and Flat Oval: 2.
- D. Exhaust Ducts:
 - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
 - 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
 - 3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
 - a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
 - b. Concealed: Type 304, stainless-steel sheet, No. 2D finish.
 - c. Welded seams and joints.
 - d. Pressure Class: Positive or negative 2-inch wg.
 - e. Airtight/watertight.
 - 4. Ducts Connected to Dishwashers, Dishwasher Hoods, and Other High-Humidity Locations:
 - a. Type 304, stainless-steel sheet.
 - b. Exposed to View: No. 4 finish.
 - c. Concealed: No. 2D finish.
 - d. Welded longitudinal seams; welded or flanged transverse joints with watertight EPDM gaskets.
 - e. Pressure Class: Positive or negative 2-inch wg.
 - f. Airtight/watertight.
 - 5. Ducts Connected to Fans Exhausting Fume Hood, Laboratory, and Process (ASHRAE 62.1, Class 3 and Class 4) Air:
 - a. Type 316, stainless-steel sheet.
 - 1) Exposed to View: No. 4 finish.
 - 2) Concealed: No. 2B finish.
 - b. Pressure Class: Positive or negative 3-inch wg.

- c. Welded seams and joints.
- d. Airtight/watertight.
- E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 8.
 - d. SMACNA Leakage Class for Round and Flat Oval: 8.
 - 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
 - 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
- F. Intermediate Reinforcement:
 - 1. Galvanized-Steel Ducts: Galvanized steel.
 - 2. PVC-Coated Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
 - 3. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
 - 4. Aluminum Ducts: Aluminum.
- G. Liner:
 - 1. Supply-Air Ducts: Fibrous glass, Type I, I inch(es thick.
 - 2. Return-Air Ducts: Fibrous glass, Type I, 1 inch(es thick.
 - 3. Exhaust-Air Ducts: Fibrous glass, Type I, inch(es thick.
 - 4. Supply Fan Plenums: Fibrous glass, Type II, 1 inch(es thick.
 - 5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 2 inches thick.
 - 6. Transfer Ducts: Fibrous glass, Type I, 1 inch(es thick.
- H. Double-Wall Duct Interstitial Insulation:

- 1. Supply-Air Ducts: 1-1/2 inches thick.
- 2. Return-Air Ducts: 1-1/2 inches thick.
- 3. Exhaust-Air Ducts: 1 inch thick.

I. Elbow Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
- 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
- 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.

- Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
- Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
- 4) Radius-to Diameter Ratio: 1.5.
- b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
- c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

J. Branch Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Conical spin in.
- Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

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SECTION 23 3300 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

I.2 SUMMARY

- A. This Section includes the following:
 - 1. Backdraft dampers.
 - 2. Manual volume control dampers.
 - 3. Fire and smoke dampers.
 - 4. Actuators.
 - Duct silencers.
 - 6. Turning vanes.
 - 7. Duct-mounted access doors and panels.
 - 8. Flexible connectors.
 - 9. Flexible ducts.
 - 10. Accessories hardware.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 23 Section "Air Outlets and Inlets" for diffusers, registers, and grilles.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data including details for materials, dimensions of individual components, profiles, and finishes for the following items:
 - 1. Backdraft dampers.
 - 2. Manual volume control dampers.
 - 3. Fire and smoke dampers.
 - 4. Duct-mounted access panels and doors.
 - 5. Flexible ducts.
- C. Shop drawings from manufacturer detailing assemblies. Include dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection. Detail the following:

- 1. Special fittings and volume control damper installation (both manual and automatic) details.
- 2. Fire and smoke damper installations, including sleeves and duct-mounted access door and panel installations.
- D. Product Certification: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static pressure loss, and dimensions and weights.

1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Comply with the following NFPA Standards:
 - 1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 MANUAL VOLUME CONTROL DAMPERS

- A. General: Provide factory-fabricated volume-control dampers, complete with required hardware and accessories. Stiffen damper blades to provide stability under operating conditions. Provide locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class. Extend axles full length of damper blades. Provide bearings at both ends of operating shaft.
- B. Standard Volume Control Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside of air stream, and suitable for horizontal or vertical applications.
 - 1. Steel Frames: Hat-shaped, galvanized-steel channels, minimum of 16 gage, and with mitered and welded corners. Provide frames with flanges where indicated for attaching to walls. Provide flangeless frames where indicated for installation in ducts.
 - 2. Roll-Formed Steel Blades: 16-gage galvanized steel.
 - 3. Blade Axles: Galvanized steel.
 - 4. Tie Bars and Brackets: Galvanized steel.

2.2 FIRE DAMPERS

- A. General: UL labeled according to UL Standard 555 "Standard for Fire Dampers." Refer to Fire Damper Schedule at the end of this Section.
- B. Fire Rating: 1-1/2 or 3 hours, as indicated.
- C. Frame: Type B; fabricated with roll-formed, 21-gage, galvanized-steel; with mitered and

interlocking corners.

- D. Mounting Sleeve: Factory-installed or field-installed galvanized steel.
 - 1. Minimum Thickness: 0.056-inch (16-gage) or 0.138-inch (10-gage) thick as indicated, and length to suit application.
 - 2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of the wall or floor, and thickness of damper frame meets sleeve requirements.
- E. Mounting Orientation: Vertical or horizontal as indicated.
- F. Blades: Roll-formed, interlocking, 21-gage galvanized steel. In place of interlocking blades, provide full-length, 21-gage, galvanized-steel blade connectors.
- G. Horizontal Dampers: Include a blade lock and stainless steel negator closure spring.
- H. Fusible Link: Replaceable, 165 deg F rated.

2.3 CEILING FIRE DAMPERS

- A. General: UL listed and labeled; comply with the construction details for the tested floor/roof-ceiling assemblies as indicated in the UL Fire Resistance Directory.
- B. Frame: 20-gage, rectangular or round, galvanized steel; style to suit ceiling construction.
- C. Blades: 22-gage galvanized steel with nonasbestos refractory insulation.
- D. Fusible Link: Replaceable, 165 deg F rated.

2.4 TURNING VANES

A. Manufactured Turning Vanes: Fabricate of 1-1/2-inch-wide, curved blades set at 3/4 inch on center, support with bars perpendicular to blades set at 2 inches on center, and set into side strips suitable for mounting in ducts.

2.5 DUCT-MOUNTED ACCESS DOORS AND PANELS

- A. General: Refer to the Access Door Materials Schedule at the end of this Section for frame and door thickness, number of hinges and locks, and location of locks. Provide construction and airtightness suitable for duct pressure class.
- B. Frame: Galvanized sheet steel. Provide with bend-over tabs and foam gaskets.
- C. Door: Double-wall, galvanized sheet metal construction with insulation fill and thickness, number of hinges and locks as indicated for duct pressure class. Provide vision panel where indicated. Provide

1-inch by 1-inch butt hinge or piano hinge and cam latches.

- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber seals.
- E. Insulation: 1-inch thick fiber glass or polystyrene foam board.

2.6 FLEXIBLE CONNECTORS

- A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL Standard 181, Class 1.
- B. Standard Metal-Edged Connectors: Factory-fabricated with a strip of fabric 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 24-gage, galvanized sheet steel or 0.032-gage aluminum sheets. Select metal compatible with connected duct system. Fold and crimp metal edge strips onto fabric as illustrated in SMACNA HVAC Duct Standard, 1st Edition, Figure 2-19.
- C. Conventional, Indoor System Flexible Connectors Fabric: Glass fabric double coated with polychloroprene.
 - 1. Minimum Weight: 26 oz. per sq yd.
 - 2. Tensile Strength: 480 lb per inch in the warp and 360 lb per inch in the filling.
- F. Conventional, Outdoor System Flexible Connectors Fabric: Glass fabric double coated with Du Pont's HYPALON or other synthetic-rubber weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.
 - 1. Minimum Weight: 26 oz. per sq yd.
 - 2. Tensile Strength: 530 lb per inch in the warp and 440 lb per inch in the filling.

2.7 FLEXIBLE DUCTS

- A. General: Comply with UL 181, Class 1.
- B. Flexible Ducts Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch-thick, glass fiber insulation around a continuous inner liner.
 - 1. Reinforcement: Steel-wire helix encapsulated in the inner liner.
 - 2. Outer Jacket: Polyethylene film.
 - 3. Inner Liner: Polyethylene film.

2.8 ACCESSORIES HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket and a flat mounting gasket. Size to allow insertion of pitot tube and other testing instruments and provide in length to suit duct insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of duct accessories. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install duct accessories according to manufacturer's installation instructions and applicable portions of details of construction as shown in SMACNA standards.
- B. Install volume control dampers in lined duct with methods to avoid damage to liner and to avoid erosion of duct liner.
- C. Provide test holes at fan inlet and outlet and elsewhere as indicated.
- D. Install fire and smoke dampers according to the manufacturer's UL-approved printed instructions.
- E. Install fusible links in fire dampers.
- F. Label access doors according to Division 23.

3.3 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire and smoke dampers for proper action.
- C. Final positioning of manual dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

ACCESS DOOR MATERIALS SCHEDULE

DUCT	DOOR	NUMBER	2			
PRESSURE	SIZE	OF NUMBER METAL GAGE		GAGE		
CLASS	INCHES	HINGES	LOCKS	FRAME	DOOR	BACK
2 INCHES	12X12	2	1-S	24	26	26
& LESS	16x20	2	2-S	22	24	26
	24X24	3	2-S	22	22	26
S: SIDE						
T: TOP						
B: BOTTOM	1					

END OF SECTION

SECTION 23 3439 - HIGH-VOLUME, LOW-SPEED FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes high-volume, low-speed fans.

1.3 DEFINITIONS

A. HVLS - High volume, low speed.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, furnished specialties, and accessories for each fan.
 - 2. Certified fan performance curves with system operating conditions indicated.
 - 3. Certified fan sound-power ratings.
 - 4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 5. Material thickness and finishes, including color charts.
 - 6. Fan speed controllers.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies. Show dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans and details, drawn to scale and coordinated with each other, using input from installers of the items involved.
- B. Qualification Data:

- 1. Factory installation required to maintain 15 year warranty for both mechanical and electrical.
- C. Seismic-Restraint Details:
 - 1. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - 2. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - 3. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For HVLS fans to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide certification that manufacturer complies with the most recent edition of ISO 9001.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by HVLS fan manufacturer.
 - 1. Factory installation required to maintain 15 year warranty for both mechanical and electrical.
 - 2. Installer certification shall be valid and current for duration of Project.
 - 3. Retain copies of Installer certificates on-site and include within closeout documents.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in a clean and dry place.
- B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.
- C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.
- D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.

- 1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
- 2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remove coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.
- E. Replace installed products damaged during construction.

1.9 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of fans that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. For Motor, Including Controls: 15 year(s) from date of Substantial Completion.
 - b. For Parts, Including Blades and Hub: 15 year(s) from date of Substantial Completion.
 - c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Listed and labeled to UL 507.
- C. CSA Compliance: Listed and labeled to CSA C22.2, No. 113.
- D. AMCA Compliance:
 - 1. Test HVLS fans according to AMCA 230.
 - 2. Certify HVLS fan performance according to AMCA 211.
- E. Performance Data: Comply with ANSI 230 test procedure standard, based on five rating points: 20-, 40-, 60-, 80-, and 100-percent of maximum speed. Comply with AMCA 211 for publication of performance data.

2.2 CAPACITIES AND CHARACTERISTICS

- A. Fan: Reference drawings for schedule information.
- B. Motor: Reference drawings for schedule information.

2.3 MANUFACTURERS

A. Approved equals: Big Ass Fans, Greenheck, and Macro Aire

2.4 HIGH-VOLUME, LOW-SPEED FANS

- A. Description: Factory-assembled and -tested horizontal, non-ducted fan unit, consisting of largediameter blade set, direct-drive electric motor, with variable-speed motor controller.
 - 1. Provide fan designed to circulate large air volume, vertically, at low velocity.
 - 2. Maximum Operating Temperature: 122deg F.
 - 3. Frame:
 - a. Material: Reference Drawing Schedule.
 - 1) Finish: Reference Drawing Schedule
 - 4. Diameter: Reference Drawing Schedule.
 - 5. Blades: Airfoil type.
 - a. Quantity: Reference Drawing Schedule.
 - b. Material: Reference Drawing Schedule
 - 1) Blade Finish: Reference Drawing Schedule
 - 6. Motor: totally enclosed fan cooled.
 - 7. Wiring and Controls Enclosure:
 - a. NEMA 250, Class 4X .
 - b. Grounded.
 - 8. Controls: Provide wall-mounted keypad.
 - a. Provide variable speed motor controller speed control.
 - 9. Maximum Sound Power Level: Reference Schedule.
 - 10. Standard Mounting Bracket: Steel beam/steel angle.
 - 11. Accessories: Reference drawing schedule

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with requirements for installation tolerances and other conditions affecting HVLS fan performance, maintenance, and operations.

- 1. Fan locations indicated on Drawings are approximate. Determine exact locations before roughing-in for mounting, control, and electrical connections.
- B. Examine roughing-in for mounting location, anchor-bolt sizes, and locations, to verify actual locations for mounting connections before installation of fan.
- C. Examine areas for suitable conditions where fan will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF HIGH-VOLUME LOW-SPEED FANS

- A. Install fan according to manufacturer's published instructions.
- B. Comply with NECA 1 and NFPA 70.
- C. Comply with NFPA 72 and interlock HVLS fans to shut down upon receiving an alarm from fire alarm system.
- D. Equipment Mounting:
 - 1. Anchor fan to building structure with manufacturer's recommended mounting bracket for installed condition.
 - 2. Consult a licensed professional structural engineer for mounting methods and approval for mounting to the structure. Structure must be able to withstand the torque and forces generated by the fan.
- E. Install unit to permit access for maintenance.
- F. Install parts and accessories shipped loose.

3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 26 0526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.
- E. Install power wiring to field-mounted electrical devices, furnished by fan manufacturer, but not factory mounted.

3.4 CONTROL CONNECTIONS

- A. Connect control wiring to field-mounted control devices.
- B. Connect control wiring according to Section 26 0523 "Control-Voltage Electrical Power Cables."
- C. Connect control interlock wiring between HVLS fan and other equipment to provide a complete and functioning system.
- D. Connect control wiring between fan unit control interface and control system to provide remote control and monitoring.
- E. Install control devices furnished by manufacturer, but not factory mounted.
- F. Install control wiring to field-mounted control devices, furnished by fan manufacturer, but not factory mounted.
- G. Protect installed units from damage caused by other work.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Fan or components will be considered defective if fan or components do not pass tests and inspections.
- C. Prepare and submit test and inspection reports.

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that fan is secure on mountings and supporting devices and that connections to electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers and switches.
 - 3. Verify proper motor rotation direction and free fan rotation.
 - 4. Check bearing and gearbox lubrication.
 - 5. Verify proper fan rotation. Set rotation selector to blow vertically downward during heating season, and vertically upward during cooling season.

3.7 CLEANING

A. Clean equipment externally; remove coatings applied for protection during shipping and storage, foreign material, and oily residue according to manufacturer's written instructions.

Following manufacturer's cleaning procedures, and clean with manufacturer-recommended cleaning products.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVLS fans.
- B. Video training sessions, and provide electronic copy of video to Owner.

END OF SECTION

SECTION 23 3713 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.
- B. Types of outlets and inlets required for project include the following:
 - 1. Ceiling air diffusers.
 - 2. Wall registers and grilles.
 - 3. Louvers.
- C. Refer to other Division-23 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.
- D. Refer to other Division-23 sections for balancing of air outlets and inlets; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
 - 2. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
 - 3. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
 - 4. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
 - 1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
 - 2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
 - Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.
- C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
- B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 CEILING AIR DIFFUSERS

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.
- D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on

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diffuser schedule. The following requirements shall apply to nomenclature indicated on schedule.

- 1. Diffuser Faces:
 - a. Round (RD): Round housing, core of concentric rings, round duct connection.
 - b. Square: Square housing, core of square concentric louvers, square or round duct connection.
 - c. Rectangular: Rectangular housing, core of rectangular concentric louvers, square or round duct connection.
 - d. Panel: Square or rectangular housing extended to form a panel to fit in ceiling system module, core of square or rectangular concentric louvers, square or round duct connection.
 - e. Perforated: Round, square, or rectangular housing covered with removable perforated panel in frame. Conceal air pattern devices above panel.
 - f. Linear: Extruded aluminum continuous slot, single or multiple.
- 2. Diffuser Mountings:
 - a. Stepped-Down: Diffuser housing below ceiling with perimeter flange and gasket to seal against ceiling construction.
 - b. Flush: Diffuser housing above ceiling surface with flush perimeter flange and gasket to seal against ceiling.
 - c. Lay-In: Diffuser housing sized to fit between ceiling exposed suspension tee bars and rest on top surface of tee bar.
- 3. Diffuser Patterns:
 - a. Fixed (FX): Fixed position core with concentric rings or louvers for radial air flow around entire perimeter of diffuser.
 - b. 2 Position (2-P): Manual 2-position core with concentric rings or louvers, upper position for horizontal air flow, lower position for vertical air flow.
 - c. Adjustable (ADJ): Manual adjustable core with concentric rings or louvers, fully adjustable for horizontal to vertical air flow.
 - d. 1 Way (1-W): Fixed louver face for 1-direction air flow, direction indicated on drawings.
 - e. 2 Way (2-W): Fixed louver face for 2-direction air flow, directions indicated on drawings.
 - f. 3 Way (3-W): Fixed louver face for 3-direction air flow, directions indicated on drawings.
 - g. 4 Way (4-W): Fixed louver face for 4-direction air flow, directions indicated on drawings.
- 4. Diffuser Dampers:

- a. Opposed Blade (O-B): Adjustable opposed blade damper assembly, key operated from face of diffuser.
- b. Butterfly (BTFY): Two semicircular flaps connected to linkage adjustable from face of diffuser with key, and with straightening grid.
- c. Supply and Return (S & R): For supply and return diffusers, butterfly type damper in return neck, annular adjustable dampers in supply duct.
- d. Fire Damper (F-D): Combination adjustable opposed blade damper and fusable link fire damper with UL approved link and assembly designed to meet requirements of NFPA 90A.
- 5. Diffuser Accessories:
 - a. Equalizing Deflectors (E-D): Adjustable parallel blades in frame for straightening air flow.
 - b. Smudge Ring (S-R): Extension perimeter frame around diffuser, sized so induced air impinges on frame and not on ceiling.
 - c. Plaster Ring (P-R): Perimeter ring designed to act as a plaster stop and diffuser anchor.
 - d. Extractor (EXTR): Curved blades mounted on adjustable frame to produce air scooping action in duct at diffuser take-off.
- 6. Diffuser Finishes:
 - a. White Enamel (W-E): Semi-gloss white enamel prime finish.
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering diffusers which may be incorporated in the work include, but are not limited to, the following:
 - 1. Anemostat Products Div.; Dymanics Corp. of America.
 - 2. Cranes Co.; Div. of Wehr Corp.
 - 3. Krueger Mfg. Co.
 - 4. Titus Products Div.; Philips Industries, Inc.
 - 5. Tuttle & Bailey; Div. of Interpace Corp.

2.2 WALL REGISTERS AND GRILLES

- A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.
- C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent

wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.

- D. Types: Provide wall registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule.
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering registers and grilles which may be incorporated in the work include, but are not limited to, the following:
 - 1. Anemostat Products Div.; Dynamics Corp. of America.
 - 2. Carnes Co.; Div. of Wehr Corp.
 - 3. Titus Products Div.; Philips Industries, Inc.

2.3 LOUVERS

- A. General: Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide louvers that have minimum free area, and maximum pressure drop of each type as listed in manufacturer's current data, complying with louver schedule.
- C. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.
- D. Materials: Construct of aluminum extrusions, ASTM B 221, Alloy 6063-T52. Weld units or use stainless steel fasteners.
- E. Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.
- F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering louvers which may be incorporated in the work include, but are not limited to, the following:
 - 1. Airline Products Co.
 - 2. Airolite Co.
 - 3. American Warming & Ventilating Inc.
 - 4. Arrow United Industries, Inc.
 - 5. Construction Specialties, Inc.
 - 6. Dowco Corp.
 - 7. Industrial Louvers, Inc.
 - 8. Louvers & Dampers, Inc.
 - 9. Penn Ventilator Co., Inc.
 - 10. Ruskin Mfg. Co.
 - 11. Safe-Air Inc.
 - 12. Snyder (E.G.) Co., Inc.

13. Vent Products Co., Inc.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.
- B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.
- C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

3.3 SPARE PARTS

A. Furnish to Owner, with receipt, 3 operating keys for each type of air outlet and inlet that require them.

END OF SECTION

SECTION 23 5523.16 - HIGH-INTENSITY, GAS-FIRED, RADIANT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. High-intensity, infrared, gas-fired, radiant heaters.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and mounting/ attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Detail fabrication and assembly of high-intensity, gas-fired, radiant heaters, as well as procedures and diagrams.
 - 4. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Structural members to which equipment will be attached.
 - 2. Gas piping to heater installations
 - 3. Thermostats and wiring to heaters.
 - 4. Heater locations and clearance requirements.
 - 5. Other suspended ceiling components:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.

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- c. Sprinklers.
- d. Structural
- B. Field quality-control reports.
- C. Sample Warranty: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas-fired, radiant heaters to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Igniter: One hot-surface burner igniter(s) for each style of high-intensity, gas-fired, radiant heater furnished.

1.7 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of radiant heaters that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: All warranty periods listed below are from date of Substantial Completion.
 - a. Ceramic Tiles: 5 years.
 - b. Heater Components: 1 year.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ANSI Z83.19A.
 1. UL listed and labeled, with UL label clearly visible on units.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 HIGH-INTENSITY, INFRARED, GAS-FIRED, RADIANT HEATERS

A. Approved Manufacturers: Detroit Radiant Products Re-Verber-Ray, Modine, Space-Ray, Schwank

- B. Factory-assembled, indoor, overhead-mounted, electrically controlled, high-intensity, infrared, radiant heating units using gas combustion. Heater to have all necessary factory-installed wiring and piping required prior to field installation and startup.
- C. Fuel Type: Design burner for natural or propane gas having characteristics same as those of gas available at Project site. Reference plans for gas requirement (natural or propane).
- D. Main Housing: Continuous, one-piece, aluminized-steel unit without gaps between housing and reflectors.
- E. Burner Assembly:
 - 1. Modular, aluminized steel with powder-coat or similar finish plenum chamber coated with ceramic fiber insulation secured with stainless-steel retainers.
- F. Emitter: Perforated ceramic tiles.
- G. Reflector: One-sided bright polished aluminum
- H. Ignition:
 - 1. Direct Spark: 120 or 24 volts, solid-state ignition module with spark electrode and flame sensor.
- I. Accessories: Reference plans.
- J. Capacities and Characteristics: Reference plans.
- K. Mounting Angle: Reference plans.

2.3 CONTROLS AND SAFETIES

- A. Failure Safeguards: 100 percent main gas shutoff on pilot or power failure.
- B. Thermostat: Reference Specification Section 23 0920 Temperature Control System and Facility Management Control System.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine structures, substrates, areas and conditions, with Installer present, for compliance with requirements for installation tolerances, required clearances, and other conditions affecting performance of the Work.
- B. Examine roughing-in for fuel-gas piping to verify actual locations of piping connections before equipment installation.

- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Equipment Mounting: Install gas-fired, infrared heaters with continuous-thread hanger rods and spring hangers of size required to support weight of heaters.
 - Comply with requirements for vibration isolation devices specified in Section 23 0548.13 "Vibration Controls for HVAC."
 - Comply with requirements for hangers and supports specified in Section 23 0529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Equipment Installation: Install gas-fired, radiant heaters and associated gas features and systems according to NFPA 54.
- C. Suspended Units: Reference plans for details.
 - 1. Comply with requirements for hangers and supports specified in Section 23 0529 "Hangers and Supports for HVAC Piping and Equipment."
- D. Maintain manufacturers' recommended clearances for combustibles.

3.3 CONNECTIONS

- A. Gas Piping: Comply with Section 23 1123 "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.
 - 1. Gas Connections: Connect gas piping to radiant heaters according to NFPA 54.
- B. Where installing piping adjacent to gas-fired, radiant heaters, allow space for service and maintenance.
- C. Electrical Connections: Comply with applicable requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."
 - 1. Install electrical devices furnished with heaters but not specified to be factory mounted.

3.4 ADJUSTING

- A. Adjust initial-temperature set points.
- B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections :

- 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- 2. Verify bearing lubrication.
- 3. Verify proper motor rotation.
- 4. Test Reports: Prepare a written report to record the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- B. Gas-fired, radiant heaters will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION

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SECTION 260100

ELECTRICAL

PART 1 - GENERAL

1.01. RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections apply to work specified in this section.

1.02. QUALIFICATIONS OF ELECTRICAL CONTRACTORS:

A. Electrical contractor must be properly established as an electrical contractor by the State of Alabama. Electrical contractor shall have had previous experience in the satisfactory installation of at least three systems of this type and size in the State of Alabama.

1.03. CODES, PERMITS AND INSPECTIONS:

- A. Comply with applicable laws of the community, with latest edition of National Electrical Code (NEC), NFC 70, and the International Building Code(IBCC) or the edition adopted by the local authority having jurisdiction, where not in conflict with those laws, and with the service rules of the local utility company.
- B. Obtain and pay for all permits and deposits, and arrange for inspections as required.
- C. After completion of the work, submit certificate of final inspection and approval from the local electrical inspector, certifying that the installation complies with all regulations governing same.

1.04. MATERIALS:

- A. All materials shall be new, and UL approved where a standard has been established.
- B. Manufacturers' names and model numbers shown on the plans and in the specifications are given to indicate the type and general quality of items to be provided. Equal products by other manufacturers will be accepted.
- C. Material substitutions will be considered only when evidence of equality and suitability, satisfactory to the Architect/Engineer has been presented in writing, with samples if requested by the Architect/Engineer. All prior approvals must have the approval of the engineer of record at the offices of Gunn and Associates, P.C. located at 3102 Highway 14, Millbrook, AL 36054, Phone: 334-285-1273, Fax: 334-285-1274
- D. All proposed substitutions shall be approved in writing at least ten (10) days prior to the bid date.
- E. It shall be understood that the Architect/Engineer has the authority to reject any material or equipment used which is not specified or approved, or showing defects of manufacture or workmanship, before or after such material or equipment is installed.

1.05. WORKMANSHIP:

A. Execute all work so as to present a neat and workmanlike appearance when completed.

1.06. DESCRIPTION OF WORK:

- A. Furnish all labor and materials required to complete the electrical work indicated on the drawings or herein specified. Major work included in Section 26 shall be:
- B. Arrange with the local utility companies for providing such electrical services as indicated on drawings or herein specified. Any charges for electrical service to the facility by the utility company shall be included in the contractor's bid price.
- C. Remove or relocate all electrical or electronic services located on or crossing through the project property, either above or below grade, which would obstruct the construction of the project or conflict in any manner with the complete project or any code pertaining thereto.
- D. Furnish and install a complete electrical light and power system including but not limited to the connection of all meters, switchboards, panelboards, circuit breakers, power outlets,

convenience outlets, lighting fixtures, switches, and/or other equipment forming part of the electrical system.

- E. Furnish and install Closed-Circuit Television (CCTV) system, including all required components and interfaces with other trades and systems. Components may include, but are not limited to, Digital Video Recorder and Multiplexer, Cameras, and all other necessary accessories and cabling to provide a complete and functional CCTV system which meets the requirements set forth in these specifications, NFPA 70, and local codes. See appropriate specification section.
- F. Connect all electrical equipment whether furnished by this contractor or by others.
- G. Furnish and install all disconnect switches not included as an integral part of equipment.
- H. Furnish and install a complete Fire Alarm System and mass notification system compliant with applicable provisions of the International Building Code (IBC) and the National Fire Protection Association (NFPA) Standard No. 72. See appropriate specification section.
- I. Complete the alterations, additions, and renovations to the electrical system in the existing building as specified herein or as shown on the drawings.
- J. Procure and pay for permits and certifications as required by local and state ordinances and Fire Underwriters certificate of inspection.
- K. Visit the site and determine conditions that affect this contract. Failure to do so will in no way relieve the Contractor of his responsibility under his contract.
- L. Submit to the Architect a certificate of final inspection from local and/or state inspection authorities.
- M. Establish and maintain temporary electrical services for construction purposes.

1.07. DRAWINGS AND SPECIFICATIONS:

- A. This Contractor shall examine drawings and Specifications relating to the work of all trades and become fully informed as to the extent and character of work required and its relation to all other work in the project prior to submission of bid and prior to the start of any construction.
- B. Drawings and Specifications shall be considered as complementary each to the other. What is called for by one shall be as binding as if called for by both. Where conflicts occur, secure clarification from the Architect in advance of bidding; otherwise incorporate the more stringent conditions into the bid price.
- C. Omissions from the drawings and specifications or the mis-description of details of work which are evidently necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omissions and details of work; they shall be performed as if fully and correctly set forth and described in the drawings and specifications
- D. The drawings indicate diagrammatically the extent, general character, and the approximate location of the work to be performed. In the interest of clearness, the work is not always shown to scale or exact location. Check all measurements, locations of conduit, fixtures, outlets, and equipment with the detailed architectural, structural, and mechanical drawings, and lay out work so as to fit in with ceiling grids, ductwork, sprinkler piping and heads, and other parts. Take finished dimensions at the job site in preference to using scale dimensions.
- E. Where the work is indicated but with minor details omitted, furnish and install the work complete so as to perform its intended functions.
- F. Where doubt arises as to the meaning of the plans and specifications, obtain the Architect's decision before proceeding with parts affected; otherwise assume liability for damage to other work and for making necessary corrections to work in question.
- G. Except as noted above, make no changes in or deviations from the work as shown or specified except on written order of the Architect.

1.08. EXISTING CONDITIONS:

- A. Before submitting a bid, visit the site and ascertain all existing conditions.
- B. Make such adjustments in work as are required by the actual conditions encountered.

C. No consideration will be given after bid opening for alleged misunderstandings regarding utility connections, integration of work with existing system, or other existing conditions.

1.09. SUBMITTALS:

- A. Follow procedure outlined in Division 1.
- B. Submittals shall be bound together and shall include a coversheet indicating the following:
 - 1. Project name
 - 2. Trade contractor's name
 - 3. Supplier's name
 - 4. Name and phone number of supplier's contact person
 - 5. A list of each item submitted with manufacturers' names and model numbers.
- Within 20 days of award of contract and prior to beginning any work on the project submit six
 (6) copies of manufacturer's drawings/data sheets for the following items to the Engineer for review:
 - 1. Conductors
 - Cable Pulling tensions. Provide cable pull tension calculations (lateral and longitudinal) on all underground cable runs over 150 feet for cables sized #1 and larger. Provide one line diagram indicating pulling tensions on each run and number and size of each pull box along anticipated route. Calculations shall include changes in direction or elevation of feeder runs.
 - 3. Wiring Devices
 - 4. Conduit Wrapping Tape
 - 5. Panelboards
 - Power system breaker coordination. Submit proper breaker settings recommendations with breaker coordination study.
 - 7. Contractor shall coordinate with mechanical/plumbing shop drawings prior to submitting power package to engineer. Adjust overcurrent devices accordingley.
 - 8. Disconnect Switches
 - 9. Closed Circuit Television System including all components
 - 10. Fire Stopping
 - Lighting Control System: Occupancy sensors, power packs and all associated low-voltage cabling. Coordinate with lighting control riser on drawings for further shop drawings requirements.
 - 12. Lighting Fixtures (include photometric data for each fixture)
 - a. Lamps
 - b. Ballasts
 - 13. Fixture Support Equipment
 - 14. Lighting Standards (Poles)
 - 15. Data/Telecommunications System
 - a. Cable
 - b. Equipment
 - c. Installer qualifications
 - d. Makes and Model Numbers of Testing Equipment to be used.
 - 16. Secondary Surge Arresters
 - 17. Transient Voltage Surge Suppressors(Surge Protective Devices)
 - 18. Fire Alarm System: The fire alarm shop drawings shall bear the approval of the fire protection provider to insure all supervisory vavles and flow switches are being monitored by the fire alarm system. Coordinate with fire protection provider prior to bid and provide monitoring for all supervisory vavles and flow switches for entire building. Bid accordingly. Include conduit and cable layout, battery calculations, terminal to terminal wiring showing color code and wire numbers, and complete technical data on each system component. Additionally, the contractor or his/her fire alarm system vendor shall provide audibility calculations indicating compliance with all applicable provisions of NFPA 72 and the IBC. The contract drawings indicate a minimum design required to comply with applicable codes. However, since devices vary from manufacturer to manufacturer the contractor shall be

responsible for furnishing any/all additional devices as required to provide audibility and visibility levels that comply with applicable sections of NFPA 72 and IBC. Furnish the Owner one set of as built drawings at completion of the project. Provide a copy of the fire alarm contractor's State Fire Marshal's Permit with the submittals for approval.

- 19. J-Hooks
- D. Submit samples upon request.
- E. The Contractor is responsible for verifying all quantities and for verifying and coordinating dimensional data with the available space for items other than the basis of design.
- F. Provide a ½"= 1'- 0" scale drawing of all electrical rooms containing more than a single panelboard section or containing a panelboard and other electrical and/or mechanical equipment. These drawings shall be submitted along with equipment data sheets.
- G. The contractor shall review and approve, or make appropriate notations on each item prior to submittal to the architect. Submittals without contractor's approval will be rejected.

1.10. COORDINATION OF SERVICE WITH OTHER TRADES:

- A. It shall be the responsibility of the Electrical Contractor to coordinate the electrical service characteristics to each piece of electrically operated equipment with all trades providing electrically operated equipment.
- B. Within ten (10) working days of notification to proceed with construction from the Architect, the Electrical Contractor shall notify, in writing, all trades providing electrically operated equipment the characteristic of the electrical power being supplied to each piece of electrically operated equipment.
- C. A copy of this notification shall be provided to the General Contractor and the Architect.
- D. Be informed as to equipment being furnished by other trades, but not liable for added cost incurred by equipment substitutions made by others which require excess electrical wiring or equipment above that indicated on drawings or specified.
- E. The contractor providing the equipment shall be responsible for the additional costs.

1.11. PROGRESS OF WORK:

A. Schedule work as necessary to cooperate with other trades, Do not delay other trades. Maintain necessary competent mechanics and supervision to provide an orderly progression of the work.

1.12. PROTECTION OF PERSONS AND PROPERTY DURING CONSTRUCTION:

- A. Take all precautions necessary to provide safety and protection to persons and the protection of materials and property.
- B. Protect items of equipment from stains, corrosion, scratches, and any other damage or dirt, whether in storage, at job site or installed. No damaged or dirty equipment, lenses, or reflectors will be accepted.
- C. Live panelboards, outlets, switches, motor control equipment, junction boxes, etc., shall be protected against contact of live parts and conductors by personnel.

1.13. CLEANING UP:

A. During the progress of work, keep the Owner's premised in a neat and orderly condition, free from accumulation of debris resulting from this work. At the completion of the work, remove all material, scrap, etc. not a part of this Contract.

1.14. AS-BUILT DRAWINGS, AND OPERATING AND MAINTENANCE INSTRUCTIONS:

A. Prior to the Final Acceptance Inspection the Contractor shall turn over to the Architect one set of reproducible "as built" drawings, including corrected fire alarm system shop drawings, three (3) sets of all equipment catalogs and maintenance data, manufacturers' warranties, and three (3) sets of shop drawings on all equipment.

1.15. TESTING:
A. Upon completion of the work, conduct a thorough test in the presence of Architect or his representative, and demonstrate that all systems are in perfect working condition.

1.16. INSPECTIONS:

- A. The contractor shall have all systems ready for operation and an electrician available to remove panel fronts, coverplates, fixture doors, etc., at the final inspection and any other scheduled inspections.
- B. It is the contractor's responsibility to have the job ready for inspections when they are scheduled. We will perform inspections as required by our contract. If project is not ready during inspection and requires a re-inspection by Gunn & Associates, then the contractor shall pay Gunn & Associates, P.C. for the re-inspection. The payment shall be made directly to Gunn & Associates, P.C. in the amount to be determined by engineer. Not to exceed \$1,000 for single re-inspection fee. Payment must be received by Gunn & Associates prior to scheduling re-inspection.
- C. Inspections for Temporary or Permanent Power required by any utility companies are not in our scope of work. If contractor needs Gunn & Associates, P.C. to perform inspections, contractor must include an inspection cost of \$1,000 per inspection in their base bid. Payment must be received by Gunn & Associates prior to scheduling inspection.

1.17. DEMONSTRATION:

A. By on-off, stop-start operation, demonstrate to the Owner or his representative, the use, working, resetting, and adjusting of each and every system. Submit statement initialed by the Owner that such demonstration has been made.

1.18. WARRANTY:

- A. Warrant the entire electrical system in proper working order. Replace, without additional charge, all work or material that may develop defects (ordinary wear and tear or damage resulting from improper handling excepted) within a period of one year from date of final acceptance. Provide the owner with two bound copies of all manufacturers' warranties.
- B. Data and Telecommunications system cabling shall be warranted for a minimum of 15 years.

1.19. TEMPORARY SYSTEMS:

- A. The Electrical Contractor shall be responsible for furnishing and installing equipment and materials necessary for providing electrical power and lighting where needed for the construction of the project.
- B. Electrical Contractor will be responsible for paying for and providing temporary construction power and lighting for entire job site. Coordinate with local jurisdictions and utility companies and pay all fees necessary to get temporary power to the job site. General Contractor shall be responsible for all monthly utility cost for duration of project or date of Final Acceptance.

1.20. SERVICE INTERRUPTION CLEARANCE WITH OWNER:

A. Before submitting a proposal, check with the Owner concerning interruption of service to the existing electrical systems. No interruption shall be made except at such time and for such duration as approved by the Owner. The Contractor's bid shall include all necessary over-time and weekend work.

1.21. DEFINITIONS:

"AWG" - American Wire Gauge

"ADA" - Americans with Disabilities Act

"As required" - Any and all items required to complete the installation of an item so as to perform its intended function.

"Circuiting" - Conductors, raceways, raceway fittings, and associated hardware.

"EMT" - Electrical Metallic Tubing, "thin wall"

"IBC" - International Building Code

"Install" - furnish, install, and make all necessary connections to and/or for the item(s) indicated or specified.

- "NEC" National Electrical Code, ANSI/NFPA 70, latest edition or the edition adopted by the authority having jurisdiction.
- "Necessary" Any and all items required to complete the installation of an item so as to perform its intended function.

"NEMA"- National Electrical Manufacturers' Association

- "NFPA" National Fire Protection Association
- "PVC Conduit" Rigid Nonmetallic Polyvinyl Chloride conduit
- "RGS Conduit" Rigid galvanized steel conduit
- "UL" Underwriters' Laboratories, Inc.

PART 2 - MATERIALS

2.01. GENERAL:

- A. This section includes all basic materials for raceways, fittings, busways, conductors, panelboards, switchboards, lighting fixtures and accessories, etc., as required for a complete installation.
- B. All materials shall be new and listed by the Underwriters Laboratories. Material substitutions will be considered only when evidence of equality and suitability, satisfactory to the Architect has been presented in writing, with samples if requested by the Architect.
- C. It shall be understood that the Architect/Engineer has the authority to reject any material or equipment used which is not specified or approved, or showing defects of manufacture or workmanship, before or after such material or equipment is installed.

2.02. CONDUITS:

- A. Rigid Metal (Galvanized Steel-RGS) Conduit: Rigid metal conduit shall be mild steel piping, galvanized inside and outside, and conform to ASA Specification 080.1 and Underwriters' Laboratories Specifications. By Sprang, Republic, Wheatland, Triangle or Pittsburgh.
- B. Intermediate Metal Conduit (IMC): IMC shall be hot dipped galvanized inside and outside and manufactured in accordance with U.L. Standard #6 or #1242. By Allied or approved equal.
- C. Electrical Metallic Tubing (EMT): EMT shall be high grade steel electro-galvanized outside and lacquer or enamel coating inside and conform to ASA Specifications 080.1 and Underwriters' Laboratories Specifications. By Sprang, Republic, Wheatland, Triangle or Pittsburgh.
- D. Rigid Nonmetallic Conduit (PVC): PVC conduit where exposed shall be high impact Schedule 80; below grand and below or in slab PVC shall be of high impact Schedule 40 PVC and shall conform to Underwriters' Laboratories Standard UL-651. By Carlon, Kraley Pittsburgh, R.G. Sloan or Southwestern.
- E. Rigid Aluminum: Rigid Aluminum conduit shall be manufactured from 6063, t-1 aluminum alloy and shall meet the requirements of Federal Spec. WW-C-540c and ANSI C80.5 and shall be U.L. listed in accordance with UL-6. Equal to products by V.A.W. of America.

2.03. COUPLINGS, FITTINGS, AND CONNECTORS:

- A. RGS & IMC: By Appleton, Crouse-Hinds, Efcor, O-Z/Gedney, Raco, or Republic.
- B. EMT: EMT fittings shall be all steel type setscrew or insulated throat compression type. Pressure indented or slip fit type will not be accepted. All connectors to be insulated. By Appleton, Efcor, Raco Steel City, or Thomas & Betts.
- C. PVC: PVC fittings shall be of high impact PVC Schedule 40 or Schedule 80 to match the installed conduit. Joints shall be made with PVC solvent cement as recommended by manufacturer. By Pittsburgh, R.G. Sloan or Carlon.
- D. Rigid Aluminum: Fittings used with Rigid Aluminum conduit shall be formed of the same alloy as the conduit or shall be copper free cast aluminum unless specifically indicated otherwise.
- 2.04. CONDUIT BODIES:

- A. Conduit bodies shall be shall be malleable iron except in kitchen, dishwashing, and waste water treatment areas conduit bodies shall be copper free cast aluminum with stamped aluminum covers.
- B. Covers shall be screw retained with wedge nut or threaded body. Covers on bodies installed outdoors shall be approved and rated for installation outdoors.
- C. Bodies shall comply with NEC 370 and 373.
- D. RGS & IMC: By Appleton, Crouse-Hinds, Efcor, O-Z/Gedney, Raco, or Republic.
- E. Conduit cannot be used as ground. Provide separate insulated green grounding wire.

2.05. BUSHINGS:

- A. Bushings up to and including 1" shall have a tapered throat.
- B. Bushings 1-1/4" and larger shall be the insulating type.
- C. Grounding bushings shall be specification grade insulated grounding type bushings with tin plated copper grounding saddles and shall be equal to O-Z/Gedney Type BLG or HBLG.
- D. Bushings shall be zinc plated malleable iron or copper free cast aluminum.
- E. Bushings for terminating Data, Telecommunications, control, CATV, and similar conduits above ceilings and at backboards may be PVC or Polyethylene insulating bushings equal to those manufactured by Arlington Industries and Bridgeport Fittings.

2.06. EXPANSION FITTINGS:

- A. Conduit Expansion Joints shall be UL Listed.
- B. Expansion joints in rigid metal conduits shall consist of a threaded malleable iron body, pressure bushing, watertight packing, pressure ring, gasket, insulating bushing, and external grounding jumper, and shall be equal to O-Z Gedney Type AX with Type BJ bonding jumper.
- C. Expansion joints for EMT conduit shall be same as above with additional EMT couplings and connectors, and shall be equal to O-Z Gedney Type TX with Type BJ bonding jumper.
- D. Expansion joints in PVC conduit shall be equal to Carlon Series E945.
- E. Expansion joints shall provide a minimum of 4" of conduit movement.

2.07. BELOW GRADE THRU WALL WATER SEALS:

- A. Thru wall water seals for conduits penetrating exterior below grade concrete walls shall be seal systems by O-Z/Gedney or The Metraflex Company.
- B. Thru wall water seals for conduits penetrating exterior below grade concrete walls shall be Metraseal thru wall water seals by The Metraflex Company.

2.08. CONDUIT ACCESSORIES:

- A. Conduit clamps and supports for metallic conduit shall be galvanized steel by Efcor, Steel City, or Mineralac. Conduit fittings by Appleton, Crouse-Hinds, O-Z/Gedney, Pyle-National or approved equal.
- B. Conduit clamps and supports for nonmetallic conduit shall be nonmetallic high impact PVC by Carlon, Pittsburg, or Sloan.
- C. Conduit clamps for aluminum conduits shall be stainless steel or cast copper free aluminum with stainless steel fasteners.

2.09. FLEXIBLE CONDUIT:

- A. Liqudtight flexible metal conduit:
 - 1. Neoprene-jacketed liquidtight flexible metal conduit.
 - 2. Equal to Anaconda Sealtite.

2.10. ELECTRICAL TAPES:

A. General use electrical tape shall be 8 mil (.008") thick, minimum, premium grade, pressure sensitive, flame retardant, vinyl electrical tape meeting UL 510, ASTM-D-3005, and MIL-I-24391C. The tape shall be equal to 3M No. 88 or Plymouth Premium 85 CW.

- B. Rubber tape used as primary tape shall be a 30 mil (.030") thick, minimum self-amalgamating, low voltage rubber tape rated for use through 600 V. Rubber tape shall be equal to 3M No. 2150 or Plymouth 122 Rubber Tape.
- C. Electrical filler tape shall be a 125 mil (.125") thick, minimum, self-amalgamating, low voltage insulating compound rated for use through 5 kV. Filler tape shall be equal to 3M SCOTCHFILL or Plymouth 125 Electrical Filler Tape.

2.11. PIPE WRAPPING TAPE:

- A. Pipe wrapping tape shall be a 10 mil (.010") thick, minimum, pressure sensitive, vinyl tape manufactured for pipe wrapping applications.
- B. The tape shall be UV, bacteria, and fungus resistant.
- C. The manufacturer's name and tape type shall be printed on the back of the tape.
- D. Pipe wrapping tape shall be equal to Plymouth Rubber Co. PLYWRAP 11, or 3M No. 50.

2.12. WIRE NUTS:

- A. Wire nuts for conductor splicing shall be winged type connectors with a square, plated steel spring and flame retardant thermoplastic shell.
- B. The connector shall be rated for the number and size conductors being connected.
- C. The Wire Nuts shall be rated for 105°C. And UL 486C listed.
- D. Wire nuts shall be equal to connectors by Ideal/Buchanan, 3M/Scotch, or T & B,

2.13. SPLIT BOLT CONNECTORS:

- A. Split bolt connectors for splicing conductors shall be UL 486A listed, shall be tin plated copper, and shall have a hexagonal head and nut.
- B. Split bolt connectors for conductors size AWG #4 and larger shall have a serrated spacer bar between conductors.
- C. Split bolt connectors for splicing conductors AWG #12 through #6 shall be equal to lisco Type SEL and Type SK for AWG #4 and larger conductors.

2.14. MULTI-TAP CONNECTORS:

- A. Multi-tap connectors shall be insulated type
- B. Multi-tap connectors shall be rated for the conductor sizes indicated on the drawings.
- C. The connectors shall be provided for the number of conductors indicated, including any future taps shown, plus a minimum of one additional tap.
- D. Multi-tap connectors shall be equal to lisco Type PCT or Type PED-CP.

2.15. WATERPROOF WIRE JOINTS:

- A. Splices made below grade shall be made connectors, UL listed as waterproof, for below grade applications.
- B. Waterproof Twist On Connectors for Up to2#6 W/1#12 tap Conductors: Single piece wire nut pre-filled with silicone sealant. Sealant shall be rated for 45-400 degrees F. Connectors shall have same insulation rating as conductors. Sizes shall be available for connecting up to 2 #6 w1#12 tap conductors. Connectors shall be UL listed as waterproof for below grade applications and equal to Ideal Buchannan B-Cap Twist and Seal Wire Connectors, King Safety Products, Tyco/Raychem GelCap SL, or equal.
- C. Waterproof Stub Splice Kit for up to #2/0 Conductors: Kit containing connector block, outer waterproof sleeve, and lubricant. Sleeve shall have same insulation rating as conductors. Kit shall be rated for feeder wire sizes #14 through #2/0 and tap wire sizes of #14 through #6. Connectors shall be UL listed as waterproof for below grade applications and equal to Tyco/Raychem GelCap SL.
- D. Waterproof In-line Splice Kit for up to #2/0 Conductors: Kit containing connector block, outer waterproof sleeve, and lubricant. Sleeve shall have same insulation rating as conductors. Kit

shall be rated for wire sizes #6 through #350 kcm. Connectors shall be equal to Tyco/Raychem GTAP.

E. Waterproof Splice Kit for Conductors above #2/0: Kit containing connector block, outer waterproof sleeve, and lubricant. Sleeve shall have same insulation rating as conductors. Kit shall be rated for wire sizes #14 through #2/0. Connectors shall be equal to Tyco/Raychem GHFC.

2.16. PLASTIC MARKING TAPE FOR MARKING UNDERGROUND CABLES AND CONDUITS:

- A. Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch.
- B. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise.
- C. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep.
- D. The tape shall be of a type specifically manufactured for marking and locating underground utilities.
- E. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion.
- F. Tape color shall be as specified in the table below and shall bear a continuous printed inscription describing the specific utility.
 - Red: Electric

Orange: Data, Telephone, Television,

2.17. FIRE STOPPING:

- A. Fire sealant shall be intumescent caulk, putty, sheet and/or wrap/strip as required to attain the proper rating.
- B. Caulk shall be equal to 3M CP25 N/S and/or S/L.
- C. Putty shall be equal to 3M Fire Barrier Moldable Putty.
- D. Sheet equal to 3M CS195.
- E. Wrap/strip equal to 3M FS195.
- F. Equal products by Dow Corning, Hilti, and Metacaulk will be accepted.

2.18. SPACERS FOR CONCRETE ENCASED ELECTRICAL DUCTS:

- A. Spacers shall be interlocking high impact plastic assemblies, which provide horizontal and vertical spacing, and hold the ducts and re-bar, where applicable, in place.
- B. The spacers shall be equal to Carlon Snap-Lok Spacers.

2.19. JUNCTION BOXES (THRU 4-11/16"):

- A. Sheet Metal: To be standard type with knockouts made of hot dipped galvanized steel, By Steel City, Raco, Appleton or approved equal.
- B. Cast: To be type FS, FD, JB, GS or SEH as required for application.

2.20. JUNCTION AND PULL BOXES (LARGER THAN 4-11/16"):

A. Shall be cast metal for all below grade exterior use and where indicated on plans. All other shall be oil tight, JIC boxes not less than 16 gauge, equal to Hoffman type "CH" boxes.

2.21. PULL BOXES:

A. Galvanized sheet metal screw-cover type with UL label as produced by Austin, B & C Metal Stamping Company, E-Box, Hoffman, Wiegmann, or approved equal.

2.22. JUNCTION AND TERMINAL BOXES FOR AUXILIARY SYSTEMS:

- A. Junction boxes for auxiliary system circuiting splicing shall be formed of galvanized steel.
- B. Boxes shall have hinged front, locking door(s).
- C. Metal back plates shall be provided for mounting terminal strips or other devices.

- D. Screw terminal strips shall be provided with a minimum of 25 percent spare terminals.
- E. Boxes shall be sized to accommodate the terminal blocks and conductors, providing code required bending space.
- F. Boxes for auxiliary systems shall be manufactured by Austin, E-Box, Hoffman, or Wiegmann.
- G. Provide complete back boxes for all surface mounted devices. Back box shall have knockout on top and bottom as needed. Surface mounted junction boxes with devices mounted to it will not be accepted. Wiremold boxes will be accepted.

2.23. AUXILIARY GUTTERS (WIRING TROUGHS):

- A. Gutters shall be of sizes shown and/or required by the NEC (whichever is larger), constructed of code gauge, galvanized sheet steel, painted ANSI 61 gray.
- B. Gutters shall be UL listed and shall be of NEMA 3R construction in wet or damp locations or shall be as indicated on the drawings.
- C. Gutters shall be as produced by Austin, B & C Metal Stamping Company, E-Box, Hoffman, Wiegmann, or approved equal.

2.24. STRUT SYSTEM FOR SUPPORT OF ELECTRICAL EQUIPMENT:

- A. Strut shall be 1-5/8" except where heavier strut is required to support the load, for rigidity, or where specifically indicated otherwise.
- B. Cold-formed steel, ASTM A 570 or A 446 GR A.
- C. Stainless Steel Strut: Type 304, ASTM A 240.
- D. Hot Dipped Galvanized Steel Strut: Zinc coated after manufacturing operations are complete, ASTM A 123 or A 153
- E. Electro-galvanized Steel Strut: Electrolytically zinc coated, ASTM B 633 Type III SC 1.
- F. Fittings: Same material as strut, ASTM A 575, A 576, A 36, A 635, or A 240.
- G. Zinc Primer: As recommended by strut manufacturer.
- H. Strut Systems shall be as manufactured by B-Line, Erico, Globe, Kindorf, MasterStrut, Power Strut, T&B SuperStrut, or Unistrut.

2.25. OUTLET BOXES:

- A. General: Except as noted, boxes shall be standard hot dipped galvanized steel at least 1-1/2" deep, of metal at least 1/16" thick; sized to accommodate devices and conductors per NEC Article 370; product of Appleton, National, Steel City, or approved equal.
- B. Ceiling and Wall Bracket Outlets: 4" octagonal boxes with plaster rings appropriate for finish surface.
- C. Typical boxes (for switches, receptacles and auxiliary systems):
 - 4" square boxes ganged as required. Box volume shall be in accordance with NEC Section 370 – provide extensions as required.
 - Furnish with 3/4" plaster rings where employed in plaster, 1" tile covers where used in ceramic tile, 1" plaster rings where set in exposed concrete, and otherwise appropriate for surface and construction.
 - 3. Use 4-11/16" square, 2-1/8" deep boxes where more than 10 conductors enter the boxes. Provide extensions as required to provide volume per NEC.
 - 4. Where existing walls are furred out with shallow hatch channel and sheet rock then the contractor will be required to use a shallow junction as required.
 - 5. All exposed junction boxes for receptacles, communications devices, switches, and fire alarm devices shall be provided with back boxes. Do not use standard junction boxes when exposed. No exposed edges of devices plates will be allowed. No knockouts on the side of the box. Boxes shall be similar to Wiremold 500 & 700 Series.
- D. Boxes in Exposed (or Thin-Coat Plastered) Masonry: Where conduit connections permit, employ solid flush-type, square-cornered, masonry boxes with turned-in device holders; otherwise employ typical box with 1-1/2" square-cut tile cover.

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- E. Multiple Outlet Floor Boxes:
 - 1. Floor boxes shall be multi-outlet type providing space for four separate services for duplex outlets and/or Data/Telecommunications outlets.
 - Floor boxes shall be provided with covers equal to Walker S36CCTCAL(BK)(BS) flush access hatch with carpet trim for carpeted floors and S36BBTCAL(BK(BS) trim for vinyl covered floors.
 - 3. Floor boxes shall be provided with 20 amp duplex grounding duplex receptacles, isolated ground receptacles, and Data/Telecommunications outlets as indicated on the drawings.
 - 4. Data outlets shall be modular type capable of housing up to six (6) Cat 5e jacks. Boxes shall be provided with two (2) active jacks unless indicated otherwise on the drawings. Provide with communications bracket(s) equal to Wiremold #RFB4-LPB.
 - 5. Provide blank plates for all unused openings.
 - 6. The boxes shall be equal to what is specified on drawings.
- F. Boxes used with Exposed Conduit: 4" square utility boxes.
- G. Exterior Boxes: Galvanized cast-metal boxes, Crouse-Hinds Type FS or FD as appropriate. Make weatherproof with gasketed covers. Equal products by Appleton, Killark, O-Z/Gedney, or approved equal will be accepted.
- H. Exterior Boxes: All receptacle boxes shall be recessed unless specifically called out not to be. This includes exterior receptacles in all masonry type walls including but not limited to Pre-cast, Brick, Block, etc.
- I. Boxes used with Recessed Lighting Fixtures: Provide a 4" square box with blank cover.
- J. Boxes in Dry Wall Construction: Sectional type switch boxes at least 2-1/2" deep may be used instead of typical box (but not where dry wall finish is applied over masonry back-up and not where multi- gang devices occur).
- K. Boxes installed exposed in kitchen and dishwashing areas shall be copper free cast aluminum with gasketed cast coverplates, without lift cover, unless specifically indicated otherwise on the drawings.

2.26. CONDUCTORS AND CABLES:

- A. Power Conductors
 - The ungrounded conductors (phase) and the grounded conductor (neutral) of each voltage system being installed shall be phase identified the full length of the conductor with the color characteristics manufactured in the insulation of cable from the cable manufacturer. Required color cable will then be installed for the specific voltage system as identified in these specifications.
 - All conductors shall be copper with not less than 98% conductivity and with current carrying capacities per N.E.C. for 60°C. for sizes through #1 AWG and 75°C for conductors #1/0 and above.
 - 3. All conductors shall have manufacturer's name, type insulation, and conductor size imprinted on jacket at regular intervals.
 - 4. Conductors of size #10 and smaller shall be solid copper conductors with 600 volt type THHN or THWN insulation.
 - 5. Conductors of size #8 and larger shall be stranded copper conductors with 600 volt type THHN or THWN insulation.
 - 6. All motor branch circuits, HVAC, and plumbing equipment shall be stranded copper conductors with 600 volt type RHH-RHW insulation.
 - 7. All conductors installed in conduit below grade shall be rated for wet location.
 - 8. Manufacturer: Conductors shall be products of GE, Triangle, Phelps- Dodge, Anaconda, Rome, Habirshaw, General Cable, or approved equal.
 - 9. Fixture Wire:
 - a. Conductors feeding into fixtures, other than fluorescent fixtures, of 300 watts or less shall be #14, 200°C., type SF-2, for fixtures of more than 300 watts #12, 200 °C., type SF-2 shall be used.
 - b. Conductors pulled through fluorescent fixtures shall have Type TFN or TFFN fixture wire, rated 90oC.

- c. Conductors shall be by Dodge, Anaconda, Rome General Cable or Southwire.
- B. Control and Signal Wire: Conductor type TFF, minimum size #16 copper and fully color-coded, shall be used. Conductors shall be by Anaconda, Houston Wire & Cable, General Cable, Phelps Dodge, Rome, or Southwire.

2.27. WIRING DEVICES:

- A. General: Manufacturer's and catalog numbers listed are used to establish style, type and quality. Unless otherwise indicated on drawings, all wiring devices shall be UL listed, sidewired specification grade.
- B. Manufacturers: Equal devices by Hubbell, Leviton, and P & S will be accepted. All devices shall have plaster ears.
- C. Wall switches: 120/277V, 20A, AC, flush enclosed, quiet type switches with thermoplastic body and polycarbonate toggles. Switches shall meet Federal Specification WS-896. Switches shall be, Hubbell 1200 series, Leviton 1200 series, or P & S PS20AC series single pole, 2-pole, 3way, or 4-way as required.
- D. Duplex receptacles (general purpose): 125V/20A flush duplex back and side wired hard use specification grade receptacles, NEMA 5-20R configuration, with nylon face and body, grounding terminal and break-off fins for converting to 2-circuit use. Receptacles shall meet Federal Specification WC-596. Color to match wall switches. Equal to P & S 5362, Hubbell CR20, or Leviton 5362.
- E. Faceless Ground Fault Circuit Interrupter: 125V, 20 amp ground fault circuit interrupter UL listed for personnel protection, equal to Hubbell GFR5350 Series, Leviton 6490, or Pass & Seymour Series 2081.
- F. Single Receptacles: Flush Bakelite receptacles with side wiring and grounding terminal, voltage, amperage, and configuration as required for circuit indicated.
- G. Each single or multi outlet receptacle, other than straight blade, 15 or 20 amp, 120 volts, NEMA 5-15R or NEMA 5-20R, shall be provided with matching cord plugs.
- H. Plugs for kitchen equipment to be plugged into wall mounted straight blade receptacles shall be angled type.
- Wiring devices shall be of color as directed by Architect. Devices must be available in ivory, brown, black, white, and gray. Devices connected to the emergency generator shall be red in color.

2.28. DEVICE PLATES:

- A. Type appropriate for the associated wiring device, equal to Sierra Stainless Steel Smoothline. Device plates shall be of color as directed by Architect. Devices must be available in ivory, brown, black, white, and stainless steel. Provide single plate of proper gang where more than one device occurs (do not gang dimmers with rocker switches).
- B. Damp Location: 20 amp,125 and 250 volt receptacles Covers shall be weatherproof when plugs are not installed, provide cast aluminum weatherproof coverplates with single lift cover and gasket equal to Hubbell CWP26H.
- C. Wet Locations, 20 amp, 125 and 250 volt receptacles: Covers shall be weatherproof In-Use covers, rated NEMA 3R when in use and shall be constructed of cast aluminum with sealing gasket. Covers shall be equal to products by Hubbell, Leviton, Steel City, T & B, and Taymac.
- D. Coverplates for exposed cast aluminum boxes in kitchen and dishwashing areas shall be cast coverplates, without lift cover, unless specifically indicated otherwise on the drawings.
- E. Color: Wiring device cover plates shall be of color as indicated on drawings or directed by Architect. Devices must be available in ivory, brown, black, white, gray, and stainless steel.
- F. Jumbo and Mini-Jumbo plates will not be accepted.

2.29. OCCUPANCY SENSORS AND ACCESSORIES FOR LIGHTING CONTROL:

- A. Occupancy sensors shall be totally passive in nature, in that the sensors shall not emit of interfere with any other electronic device, or human characteristic. Sensors shall be dual technology, i.e.: Passive Infrared (PIR) and Microphonic.
- B. PIR shall initiate an "on" condition and the PIR or microphones shall maintain the load "on".
- C. Upon detection of human activity by the detector the lights shall come on and a time delay shall be initiated to maintain the lights on for a pre-set time period. The time delay shall be factory set and field adjustable from 30 seconds to 20 minutes.
- D. All devices shall be factory warranted for 5 years.
- E. All sensors shall be low voltage, 12 to 24 volts and shall work in conjunction with remote power packs.
- F. Occupancy sensors shall be as shown on drawings.

2.30. GROUNDING:

- A. Ground Rods shall be 3/3" x 10' copperciad steel.
- B. All grounding conductors shall be copper.

2.31. LIGHTING FIXTURES

- A. General:
 - 1. All Lighting Fixtures shall be UL labeled.
 - Fixtures installed in fire rated ceilings or ceiling assemblies shall be rated for installation in fire rated ceilings.
 - 3. Furnish fixtures complete with lamps, ballasts and internal wiring factory installed.
 - 4. Fixtures shall be furnished as specified herein and as shown on the fixture schedule on the plans. Catalog numbers shown are for basic units; furnish all fixtures complete with flexible connections, trim, plaster frames, and all other appurtenances necessary to the installation.
 - Fluorescent fixtures shall be equipped with flat, flush steel doors, unless scheduled otherwise, with spring loaded cam latches, shall be powder coat painted after fabrication, shall have lenses equal to ALP or KSH 12.125, .125" lenses, and shall be rated for installation in fire rated ceilings.
 - Substitutions: Reference to a specific manufacturer's product is made to establish a standard of quality and design, and to give a general description of the basic type desired. Equal products by the listed manufacturers will be accepted subject to the Engineer's approval.
 - It shall be the responsibility of the contractor to verify the exact type ceiling, type fixture mounting and trim, and recessing depth of all recessed fixtures prior to purchasing any fixtures.
 - Stems on stem mounted fixtures shall be approved ball aligner type, swivel 30 degrees from vertical with swivel below canopy. Paint stems the same color as the fixture trim. Stems in unfinished areas may be unpainted conduit.
 - 9. Open HID fixtures shall be provided with protective lenses or equipped with lamps and sockets(pink) rated for installation in open fixtures.
 - Fixtures installed on the exterior of buildings, on poles, or on pedestals shall be rated for wet location installation.
 - 11. Lamping for all new luminaries shall be new at the time of final acceptance. Building permanent lighting shall not be used for temporary or construction lighting at anytime prior to final acceptance. If used for temporary construction lighting, then relamp all fixtures prior to final inspection.
 - 12. All high bay fluorescent, induction or HID fixtures installed in gymnasiums, hangars or similar use areas shall be provided with wire guard.
- B. Emergency and Exit lighting Fixtures shall be equipped with a Self-testing module which shall perform the following functions:
 - 1. Continuous monitoring of charger operation and battery voltage with visual indication of normal operation and of malfunction.

- Monthly discharge cycling of battery with monitoring of transfer circuit function, battery
 capacity and emergency lamp operation with visual indication of malfunction. The battery
 capacity test may be conducted by using a synthetic load.
- 3. Manual test switch to simulate a discharge test cycle.
- 4. Modules shall have low voltage battery disconnect (LVD) and brownout protection circuit.
- All lighting fixtures and exit signs shown as emergency on drawings shall be provided with a minimum 1100 lumen emergency battery ballast capable of 90 minutes of illumination. No exceptions.
- C. Ballasts:
 - 1. It shall be the responsibility of the lighting fixture supplier to insure compatibility of the ballasts and lamps provided.
- D. Lamps: Type and size as scheduled, GE, Osram/Sylvania, Phillips, or approved equal.
 - LED bulb shape shall comply with ANSI C79.1. Lamp base shall comply with ANSI C81.61.
 - 2. Minimum CRI of LED lamps shall be 80 with a color temperature as shown on drawings.
 - 3. Rated life of all LED lamping shall me a minimum of 50,000 hours failure to 75% of lamp output.
 - 4. LED lamping shall be capable of dimming from 100% to 0%.

2.32. LIGHTING STANDARDS:

- A. Lighting Standards(Poles) shall be as specified on light fixture schedule anchor base poles rated for sustained wind's for the wind chart of this specific job's location and a 1.3 gust factor.
- B. Poles shall be of the length required to provide the scheduled fixture mounting height.
- C. Poles shall be factory predrilled for arm and fixture mounting.
- D. Hand holes shall be provided at the base end of the pole for wiring access. Handholes shall be a minimum of 3" x 5" with gasketed, weatherproof covers and stainless steel mounting hardware.
- E. A grounding lug shall be provided inside the handhole.
- F. The poles shall be furnished with a dark bronze, corrosion resistant finish, applied after fabrication.
- G. The base plate shall be furnished with slotted holes for pole alignment.
- H. A base cover shall be furnished with the pole with matching finish.
- I. Anchor bolts shall be 36" long.

2.33. PANELBOARDS:

- A. General: All panelboards shall be dead front type manufactured and installed in accordance with UL and NEMA standards, and shall carry a UL label. Ampacity, service voltage, and configuration shall be as indicated on drawings. Panelboards shall be clearly marked with ampacity, voltage, and maximum short current ratings.
- B. Manufacturer: Panelboards shall be as manufactured by Cutler-Hammer, GE, Square D, or Siemens.
- C. Enclosure:
 - 1. Panelboard enclosures shall be as indicated on drawings.
 - Unless otherwise indicated, all boxes shall be constructed of galvanized (or equivalent rust-resistant) sheet steel with hinged front trim.
 - Fronts shall be door in door with two lockable latches to open door, lock, and latch. All
 panelboard locks shall be keyed alike. Piano hinges with screw latches will not be
 permitted.
 - 4. Fronts shall be finished with gray baked enamel over a rust-inhibiting phosphatized coating.
 - All dual section panels shall be equal in size. Sub-Feed circuit breakers will not be allowed to feed second section.

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- 6. Sub-Feed circuit breakers feeding additional panels or equipment shall be branch mounted.
- 7. Provide permanent numbering of the panelboards. Stickers are not considered permanent.
- Any panelboard schedule that indicates more than 42 circuits shall be provided in two equally sized panelboards.
- 9. Main circuit breakers shall be centered mounted. Main breaker cannot be mounted on buss bars with other circuit breakers.
- D. Buss Assembly:
 - 1. Bussing shall be copper.
 - 2. The buss assembly A.I.C. shall be rated as indicated on drawings. Ratings shall be established by heat rise tests, in accordance with UL Standard 67.
 - 3. All bussing shall accept bolt on circuit breakers.
 - 4. Current carrying parts of all bussing shall be plated. In lighting and receptacle panels, bussing shall be designed for connection to the branch circuit breakers in the phase sequence format. Distribution panelboards shall be fully bussed.
 - 5. Ground bars shall be provided in all panelboards.
 - 6. Neutral bar shall be fully sized with lugs suitable for incoming and outgoing conductors.
 - 7. Provide insulated ground buss where indicated on the panelboard schedules.
- E. Circuit Breakers:
 - Circuit breakers shall be quick-make, quick-break, thermal magnetic, molded case, bolt on type.
 - Circuit Breakers shall be numbered and arranged as indicated on the panelboard schedules and/or single line wiring diagrams. Numbers shall be permanently attached to trim.
 - SWD Circuit Breakers: Single pole circuit breakers rated 15 and 20 amperes and intended to switch 277 volts or less fluorescent lighting loads shall be UL rated for switching duty and shall be marked "SWD".
 - 4. HACR Circuit Breakers: Circuit breakers 60 amperes or below, 240 volts, 1-, 2-, or 3-pole, intended to protect multi-motor and combination-load installations involved in heating, air conditioning, and refrigerating equipment shall be UL listed as HACR type and shall be marked "Listed HACR Type."
 - 5. Circuit breakers serving fire alarm systems, dedicated emergency/exit lighting circuits, and area of rescue communications systems shall be equipped with a screw-on, mechanical handle blocking device which locks the circuit breaker in the "ON" position.
 - Circuit breakers serving circuits in residential bedrooms shall be Arc Fault Interrupting(AFI) type circuit breakers and shall be UL 1699 listed.
- F. Directories:
 - 1. Each panelboard shall be equipped with a metal directory frame with a clear cover welded to the inside of the door.
- G. Equipment Short Circuit Rating: Short Circuit Interrupting Ratings shall be as indicated on the plans and schedules. Unless specifically indicated otherwise all rating are "Fully Rated" capacities. Where no rating is given, the contractor shall verify the available short current with the serving utility and provide equipment rated accordingly.
- H. Lighting panelboard cans shall be a maximum of 20" wide and 5 %" deep. Cans of multisection panelboards shall be the same size.
- I. Provide nameplate as called out on drawings.
- J. All circuit breakers 1200-amp and up shall comply with NEC Article 240.87 Arc Energy Reduction.
- K. All flush mounted panel shall be provided with six (6) ¹/₄" conduit stubbed up above accessible ceiling.

2.34. DISTRIBUTION PANELBOARDS:

A. Furnish and install distribution and power panelboards as indicated in the panelboard schedule(s) or single line wiring diagrams and where shown on the plans.

- B. Panelboards shall be dead front, safety type equipped with thermal magnetic, molded case circuit breakers with trip ratings as indicated on the schedule(s).
- C. Panelboard bussing shall be copper.
- D. Panelboard buss structure and main lugs or main breaker(s) shall have the fault current ratings as indicated on the drawings. Ratings shall be established by heat rise tests conducted according to UL Standard UL67.
- E. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other.
- F. Main circuit breakers shall be centered mounted. Main breaker cannot be mounted on buss bars with other circuit breakers.
- G. An engraved phenolic label shall be permanently attached to the front of the panelboard adjacent to each circuit breaker identifying the load served by the circuit breaker.
- H. Automatic tripping shall be clearly shown by the breaker handle taking a position between ON and OFF when the breaker is automatically tripped.
- I. Provisions for additional breakers shall be such that no additional connectors or hardware will be required to add breakers.
- J. The panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel shall be as specified in UL Standards. End walls shall be removable. The size of wiring gutters shall be in accordance with the National Electrical Code, NEMA, and UL Standards for panelboards.
- K. Cabinets shall be equipped with four piece fronts.
- L. The panelboard interior assembly shall be dead front with panelboard front removed.
- M. Main lugs or main breaker shall be barriered on live sides.
- N. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the buss structure opposite the mains shall be barriered.
- O. Circuit breakers serving Fire Alarm Systems, Security Systems, and/or Emergency/Exit lights shall be equipped with mechanical, screw-on type, locking devices. These devices shall not be padlock type devices.
- P. Panelboards shall be listed by Underwriters' Laboratories and to bear UL label. Panelboards shall be rated for use as Service Entrance Equipment where required by the National Electrical Code. Panelboards shall be by Cutler-Hammer, General Electric, Square D or Siemens.
- Q. Provide nameplate as called out on drawings.
- R. All circuit breakers 1200-amp and up shall comply with NEC Article 240.87 Arc Energy Reduction.
- S. All flush mounted panel shall be provided with six (6) ¾" conduit stubbed up above accessible ceiling.
- T. All service entrance main circuit breakers shall be 100% rated.

2.35. SAFETY SWITCHES:

- A. Furnish and install safety switches as indicated on the drawings.
- B. Switches installed on 277/480 volts systems shall be rated for 600 volts and those installed on 120/208 volt or 120/240 volt systems shall be rated for 240 volts.
- C. Switches shall be NEMA Heavy Duty Type HD and Underwriters' Laboratory listed. Safety switches shall be Cutler Hammer, Square D, Siemens, or General Electric.
- D. General Duty disconnects will not be accepted.
- E. Enclosures for switches mounted outdoors shall be NEMA 3R or as indicated on the plans.
- F. Enclosures for switches installed in kitchen and dishwashing areas shall be NEMA 4X stainless steel or as indicated on the plans.
- G. All safety switches for equipment with remote controls shall be equipped with a control circuit disconnect interlock.

- H. Switches shall be lockable in the "ON" and in the "OFF" positions.
- I. Provide each disconnect with a nameplate that indicates equipment name, voltage/phase, and feed from location.
- J. Provide keyed brass locks on all disconnects that is located on the exterior of the building or in any area that is accessible to children or the public. All the brass locks shall be keyed the same, and turn over 10 sets of keys to the owner at final acceptance.
- K. Disconnect locations shown on drawings is diagrammatically shown. Disconnects shall be coordinated with other trades and placed in the optimal locations to serve equipment and shall be installed in the least obtrusive location. Disconnects will have to be moved at the cost of the contractor when there is conflicts with NEC clearances, access to space, or servicing of equipment. Architect/Engineer will have final judgment of proper location.

2.36. MOTOR RATED SWITCHES (WITHOUT OVERLOAD PROTECTION):

- A. Motor Rated Switches without overload switches shall be rated for motor starting operation.
- B. Switches shall be 20 or 30 amp, two or three pole as required for the application.
 - 1. 20 amp two pole switches shall be 277 volt rated equal to Pass & Seymour #20AC2-HP.
 - 30 amp two pole switches shall be 277 volt rated equal to Pass & Seymour #30AC2-HP or #7802 for higher HP applications.
 - 3. Three pole switches shall be 30 amp, 600 volt switches equal to Pass & Seymour #7803.
- C. Switches installed for site disconnect switches shall be equipped with padlocking provisions.
- D. Motor Rated Switches shall be equal to Pass & Seymour #7801 or #7830 outdoor locations, installed with tamper proof screws.

2.37. MANUAL MOTOR STARTERS (TUMBLER SWITCH TYPE WITH OVERLOAD PROTECTION):

- A. Starting and thermal overload protection for single phase motors 1/8 Hp to 1 HP shall be provided by manual motor starters with overload units rated as required by the specific motor to be served.
- B. Switches installed for site disconnect switches shall be equipped with padlocking provisions.
- C. Starters shall be by Cutler Hammer, General Electric, or Siemens with NEMA Type 1 enclosure or NEMA Type 3R enclosure where installed outdoors.

2.38. INTEGRAL HORSEPOWER MANUAL MOTOR STARTERS:

- A. General: Manual motor starters for three phase motors shall be Integral Horsepower type sized as required for the motor served. Unless otherwise indicated, starters shall be full line voltage, single speed, and non-reversing type with push-button start-stop operation.
- B. Enclosures: Starters shall be furnished with NEMA 1 surface mount enclosure or NEMA 3R enclosures for outdoor installation unless otherwise indicated.
- C. Thermal protection: Each starter shall be equipped with thermal overload protection in all ungrounded phases. Protection shall consist of thermal overload relays meeting NEMA ICS 2, mounted within the starter. The proper size and number of heater elements shall be installed in each starter.
- D. Starters shall be by Cutler Hammer, General Electric, or Siemens with NEMA Type 1 enclosure or NEMA Type 3R enclosure where installed outdoors.

2.39. TRANSIENT VOLTAGE SURGE PROTECTORS (SURGE PROTECTIVE DEVICES):

- A. Provide transient voltage surge protectors (Surge Protective Devices) where indicated on the plans. At a minimum provide on all service entrance panelboards/switchboards and any panelboard/switchboards on the secondary side of a dry-type transformer.
- B. Service Entrance Panelboards and at Subpanel Protectors shall be listed and labeled and components recognized in accordance with UL 1283 and UL 1449 Second Edition, including highest fault current of Section 37.3.
- C. All devices shall meet or exceed the following:

- Minimum surge current capability, single pulse rated, per mode:
 a. Service Entrance 100 kA (200 kA per phase)
 - a. Distribution and branch panelboards 80 kA (160 kA per phase)
- 3. UL 1449, Second Edition, Listed and Labeled, and Recognized Component Suppressed Voltage Ratings shall not exceed (1.2x50 s, 6kV open circuit and 8x20 s, 500A short circuit test wave forms at end of 6" lead):

Voltage	L-N	L-G	N-G	L-L
208Y/120v	400	400	330	700

- 4. Testing shall be done at the end of 6" leads with the complete unit including any fuses and all other components making up the unit.
- D. The devices shall have a minimum EMI/RFI filtering of –50dB at 100kHz with an insertion ratio of 50:1 using MIL-STD-220A methodology.
- E. Devices shall utilize MOV's of 25 mm diameter or larger, shall have pilot lights visible on the outside of the enclosure to indicate device operating condition, and shall provide contacts for remote monitoring of device condition.
- F. Devices shall be modular in design with individual module fusing and thermal protection.
- G. Devices shall incorporate visual alarm signals that indicate the failure of a single MOV and total loss of protection.
- H. Wye connected devices shall provide L-L, L-N, L-G, and N-G surge diversion with L-N/L-G bonded at service entrance devices. Delta connected devices shall provide L-L and L-G protection.
- Data Line Surge Protectors: Data Line Surge Protectors shall be UL 497B listed and labeled. The units shall be heavy duty devices utilizing a combination of silicone diodes and gas tube technology to provide surge protection.
- J. All devices shall have a minimum warranty period of five years, incorporating unlimited replacement of suppressor parts if they fail during the warranty period.
- K. Transient voltage surge suppressors shall be manufactured by AC Data Systems, Advanced Protection Technologies, Current Technologies, Cutler-Hammer, General Electric, Joslyn, Liebert, or MCG.

2.40. SECONDARY SURGE ARRESTERS:

- A. Secondary surge arresters shall be UL listed under UL Classification (Lightning Protection) Surge Arresters(OWHX).
- B. Surge arresters shall be rated at same voltage and phase configuration as service.
- C. Arresters shall be equal to Cooper Power Systems ASZH Series, Cutler-Hammer, GE Tranquell, Joslyn Electronic Systems, Leviton, models as required to match the voltage of the system served.

2.41. FUSES:

- A. General: Fuses shall be UL listed time delay types with a minimum interrupting rating of 100,000 amps symmetrical.
- B. 200 amps and below: Provide Class RK-5 current limiting, time delay, rejection type as manufactured by Busman Manufacturing, Ferraz Shawmut, or Littlefuse.
- C. 201 to 600 amps: Class RK-1, current limiting, time delay, rejection type as manufactured by Bussman, Ferraz Shawmut, or Littlefuse.
- D. Above 600 amps: Class L current limiting, time delay, as manufactured by Busman Manufacturing, Ferraz Shawmut, or Littlefuse.

2.42. LABELING:

A. Provide laminated plastic nameplates for each panelboard, equipment enclosure, relay, switch, and device.

- B. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic 0.125 inch thick, white with black center core.
- C. Provide red laminated plastic label with white center core where indicated.
- D. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core.
- E. Minimum size of nameplates shall beone by 2.5 inches.
- F. Lettering shall be a minimum of 0.25 inch high normal block style.
- G. See Panelboard details for proper labeling of all panelboards.

2.43. CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM:

- A. General: This portion of the Work consists of replacing Closed Circuit Television (CCTV) system with new system. Work shall include but not be limited to:
 - 1. Provide new monitors as indicated on drawings.
 - 2. All required accessories and cabling to establish a fully functional system.
- B. System shall be Digital IP Cameras.
- C. Cameras: Basis of Design: Pelco D5220 (PTZ) or IXP-31 (Fixed). Provide dome cameras with the following characteristics:
 - 1. Image Sensor: 1/3" CCD
 - 2. Resolution: Full HD 1080P
 - 3. Focal Length: In the range from 2.8mm to 10mm. As required for specific application.
 - 4. Housing: Aluminum Case with Polycarbonate Dome. IP 68 weather rating. Note that the indoor camera does not require this housing type, but all cameras are being specified identically for the sake of simplifying spare parts.
 - 5. Automatic Day/Night control.
 - 6. Include wall bracket for outdoor units. Indoor unit is anticipated to be ceiling mounted.
 - 7. Basis of Design: PELCO NVR DSSRV
 - 8. Encoder: Pelco ENC5516.

D. NETWORK VIDEO RECORDER

- 1. Frame Rate: 60 FPS per Channel at 1080p.
- 2. Full HD 1920 x0 1080 monitor output.
- 3. H.264 Enhanced Compression.
- 4. Back-up via HDD, USB drive or PC via SMS Remote Software.
- 5. Storage: Adequate fr approximately 10 days with 4 cameras at 1080p resolution, 30 FPS.
- 6. Inputs from Camera: Ethernet RF-45
- 7. Output to Monitor: 1 VGA and 1 HDMI.
- 8. Connection Ports: 1-RJ-45 10/100 Mbps Ethernet; 1-RS-485; 1 USB
- 9. Basis of Design: Pelco NVR DSSRV
- E. Monitor: Provide 19" HDMI LCD monitor with wall mounting bracket. Monitor shall have 1280 x 1024 resolution, 4:3 Aspect Ratio, 1 VGA input, and 1 HDMI input.
- F. Camera Power Supply: Provide 24VAC power supply adequate for full capacity.
- G. Wiring: As required by system manufacturer.

2.44. PHOTOCELLS, TIME SWITCHES AND CONTACTORS:

- A. Photocells: Units shall have 1" diameter, hermetically sealed, cadmium sulfide sensing cell with 3-prong NEMA locking plug, rated for wet locations. Units shall have built-in time delay. Units shall be equal to Tork 5231 of correct voltage to match load or use with matching receptacle equal to Tork 2421.
- B. Time switches:

- Unless otherwise indicated on drawings, time switches shall be 24 hour electromechanical type having synchronous motor drive with two single pole double throw contacts rated 20 amps minimum.
- 2. Unit shall have spring back up, with automatic rewind, capable of providing 16 hours minimum of reserve power upon electric power failure.
- 3. Units shall be furnished in an enclosure, NEMA 1 indoor and NEMA 3 outdoors. Enclosures shall be flush mount unless otherwise indicated on drawings.
- 4. Units shall be Tork 7120L, or equal by Paragon or Sangamo.
- Time switch(es) shall be digital, seven day format, two channel time switches with 9v lithium battery 30 day back-up and with metal indoor enclosure. The controllers shall be equal to Tork #DW200A-Y.
- C. Contactors: Units shall be electrically held or electrically operated mechanically held, as indicated on drawings, and shall be recommended by manufacturer for type of load served.
- D. Contacts shall double-break type of same ampere rating as line side circuit wiring.
- E. Contacts shall be field-convertible to normally open or normally closed.
- F. Contactor coils shall be encapsulated. Electrically held contactors shall have continuously rated coils. Mechanically held contactors shall be equipped with coil-clearing contacts to energize coils only when switching.
- G. Units shall be furnished in an enclosure, NEMA 1 indoor and NEMA 3 outdoors.
- H. Units shall be equal to Square D type L or LX.

2.45. CONCRETE:

- A. Concrete for electrical requirements shall be:
 - Composed of fine aggregate (sand), coarse aggregate (graded from three-sixteenth (3/16) inch to one (1) inch), Portland cement, and water proportioned and mixed so as to produce a plastic, workable mixture.
 - 2. Aggregates shall be free from detrimental amounts of dirt, vegetable matter, soft fragments, or other foreign substances.
 - 3. Water shall be fresh, clean, and free from salts, alkali, organic matter, and other impurities.
 - 4. Concrete shall have a minimum 3000 psi ultimate twenty-eight day compressive strength and a maximum three (3) inch slump.

PART 3 - EXECUTION

3.01. GENERAL:

A. This section includes the installation of the complete electrical system.

3.02. ELECTRICAL SYSTEM DEMOLITION:

- A. Before any new work begins the Contractor shall determine and document in writing to the satisfaction of the Engineer the condition of existing electrical work and auxiliary systems that are to remain in service. After the new work begins any existing electrical work or systems that are found to be inoperative or defective and not so documented shall be repaired or replaced by the Contractor at no additional cost to the Owner.
- B. Existing electrical equipment and materials to be reused shall be tested and repaired as required and installed for first class operation.
- C. General: The manner in which the remaining portions of the electrical system are terminated, supported and generally maintained for permanent use shall comply with all applicable regulations of the National Electrical Code, applicable NFPA codes and any local codes.
- D. Refer carefully to construction drawings prior to commencing with demolition to determine the intent of demolition. Contact the Engineer if there appears to be any conflict between the demolition and construction drawings.
- E. See "Renovation" Section regarding modification and relocation of circuits.

- F. Phasing: Phasing shall be as coordinated by the General Contractor.
- G. Work in Occupied Areas: Coordinate work carefully with General Contractor to provide minimum disruption to occupied portions of project. Provide minimum of 24 hours advance notice to Owner of demolition activities that will affect Owner's normal operation.
- H. Protections: Take necessary measures as required for protection of the Owner's personnel and the general public, as well as Owner's property. Provide temporary barricades, partitions, bracing, and weather protection as needed. Remove all temporary protections at completion of work.
- I. Flame Cutting: Do not use cutting torches for removal until work area is cleared of flammable materials. Maintain portable fire suppression equipment during flame-cutting operations.
- J. System Protection: Protect and maintain all portions of existing system not indicated for demolition, including but not limited to light fixtures, panelboards and circuits.
- K. Fire Protection: Coordinate with general contractor to insure that all penetrations of fire-rated decks and partitions are properly sealed.
- L. Removal of Circuits: All circuits indicated for removal shall be entirely removed, including raceway, back to take-off point or as far as possible without chasing (unless chasing is indicated). Where it is not possible to remove conduit, all conductors shall be removed and the conduit shall be permanently capped. Floor outlets indicated for removal shall be entirely removed, including outlet box, and capped below floor level (minimum 4" below floor level if in slab).
- M. Where floor slab is damaged in the course of demolition, it shall be permanently repaired as soon as practicable.
- N. Leave existing branch circuits and feeders which run through reworked areas and serve existing equipment to remain in service, continuous and uninterrupted.
- O. Where service interruptions are required, obtain approval for interruptions in writing from Architect 14 days prior to interruption. Submit schedule of work to be performed and the time required to accomplish work with request for interruption.
- P. Disposition of Material: Where electrical equipment is indicated for removal and not indicated for re-use, the owner shall have the option of taking possession of the equipment, the Contractor shall deliver any such material to a local site designated by the owner. The Contractor shall be responsible for disposing of all other materials in accordance with applicable codes and laws.

3.03. ELECTRICAL SYSTEM RENOVATION:

- A. General: Provide renovations as indicated on drawings and specified herein as required for a complete, operational system, even though every item is not indicated.
 - 1. This Section is intended to serve as a supplement to the applicable sections within this Division, and in no way relieves the contractor from the requirements of any other Section.
 - All renovations shall comply with all applicable regulations of the National Electric Code, applicable NFPA codes and any local codes
- B. Materials and workmanship: Execute all work so as to present a neat and workmanlike appearance when completed. Except where otherwise indicated, all materials shall be new, UL approved where a standard has been established. Where specific means and methods for affecting renovations are not covered in drawings and specifications, the contractor shall exercise prudent judgment in following accepted practices.
- C. Modifications: All major deviations from the drawings and specifications shall be approved in writing by the Engineer.
- D. Inspection:
 - 1. Inspect all existing electrical system components which are accessible, including fixtures, wiring devices, raceway and panelboards.
 - Perform minor repairs to loose or damaged connections, damaged or missing supports, replacement of broken devices, replacement of missing plates and junction box covers and other visible damage or disrepair.

- 3. Report major damage to Engineer.
- E. Renovation Services: In addition to the scope of work indicated on the drawings and specified herein, it shall be the responsibility of this Division to provide minor modification and repair services made necessary to electrical system components through the normal course of renovation. Such services shall include but not be limited to minor repair or relocation of branch circuits necessitated by the work of other trades, as coordinated by the General Contractor.
- F. Penetrations: Coordinate penetrations of existing walls, decks, and roofs required for electrical system with General Contractor. Do not cut structural members without the prior consent of Structural Engineer.
- G. Raceway.
 - a. Unless specifically indicated otherwise, existing raceway may not be used.
 - b. Where existing raceway is indicated for possible re-use, it shall be the responsibility of this Division to verify that the condition and configuration of the raceway is in compliance with the NEC.
- H. Panelboards: Where new circuits are run to an existing panelboard, thoroughly inspect the panelboard for any indications of arcing, overheating, or other damage. Report damage to the Engineer. Unless specifically allowed, tandem circuit breakers shall not be utilized.
- I. Clearing of Neutral Faults: Any and all neutral faults to ground on existing system shall be corrected.
- J. Service Ground: Visually inspect existing service ground electrode system for damage and code compliance. Check continuity from panel to each electrode with a meter. Make repairs as required.
- K. Lighting Fixtures: Where existing lighting fixtures are indicated for re-use, they shall be thoroughly cleaned and relamped, no exceptions. Where existing lighting fixtures are indicated for replacement, it shall be the responsibility of this Division to verify the compatibility of new fixtures with existing ceiling type, existing penetrations, available support, and other existing conditions prior to submittal of fixtures. Any variances or required modifications shall be clearly indicated on the fixture submittal.
- L. Backfilling, Grading, and Sodding:
 - 1. Restore surface features, including vegetation, at areas disturbed by Work of this Section.
 - 2. Reestablish original grades, unless otherwise indicated.
 - 3. If sod has been removed, replace it as soon as possible after backfilling is completed.
 - 4. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition.
 - 5. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2 Section "Landscaping." Maintain restored surfaces.
 - 6. Restore disturbed paving as indicated.

3.04. ELECTRICAL SERVICE:

- A. General: Arrange with local electric Utility Company for service to be brought to the building, and for installation of meter. Provide all material and labor not supplied by Utility Company so as to produce a complete installation meeting the Utility regulations.
- B. Service requirements: It is the responsibility of this Section, prior to bid, to reaffirm with the Utility Companies involved, that locations, arrangement, Power Company voltage, phase, metering required, and connections to utility service are in accordance with their regulations and requirements. If their requirements are at variance with these drawings and specifications, contract price shall include an additional cost necessary to meet those regulations without extra cost to Owner after bids are accepted.
- C. Notify Architect of any changes required before proceeding with work.
- D. Fees and deposits:
 - 1. The Electrical Contractor shall be responsible for verification and payment of all utility fees associated with installation of the electrical service.

- 2. The Owner shall pay the cost of establishing an electrical service account and permanent meter deposit.
- E. Metering: Obtain metering equipment from Utility Company and install in compliance with the Utility Company's requirements. The Electrical Contractor shall provide and install all necessary metering raceways, fittings, supports, connectors and ground conductor necessary for a complete installation. Provide 100# pull wire in all metering conduits.
- F. Main Service Equipment: Provide UL approved service entrance components as indicated on drawings or specified herein.
- G. Provide a full size copy of the AS-BUILT Power Riser Diagram framed behind plexiglass screwed to the wall near service entrance in main electrical room.
- H. Service lateral or feeder: Extend lateral or feeder of the size shown on drawings from service equipment to the point of service as indicated (verify exact location with Utility Company).
 - 3. For Underground Service, provide and install transformer pad, primary underground conduit to utility riser as directed by Utility Company, underground secondary conduit, and secondary conductors. Conduit shall be of size and quantity as indicated on drawings. Provide spare 4" conduit in transformer pad extending 2' beyond edge of pad with PVC cap. Provide 480# polypropylene pull line in each empty conduit.
 - 4. On service transformers with multiple taps, it shall be the responsibility of this section to coordinate tap selection with the electric utility to insure the proper nominal voltage.

3.05. TELEPHONE SERVICE:

- A. General: Arrange with local telephone Utility Company for service to be brought to the building. Provide all material and labor not supplied by Utility Company so as to produce a complete installation meeting the Utility regulations.
- B. Service requirements: It is the responsibility of this Section, prior to bid, to reaffirm with the Utility Companies involved, that locations, arrangement, and connections to utility service are in accordance with their regulations and requirements. If their requirements are at variance with these drawings and specifications, contract price shall include an additional cost necessary to meet those regulations without extra cost to Owner after bids are accepted.
- C. Fees and deposits:
 - 1. The owner shall pay all utility fees and deposits associated with service installation.
 - 2. The Contractor shall pay all costs associated with the installation of the service.
- D. Telephone Backboards: Provide backboards as indicated on drawings. Backboards shall consist of a 4' x 8' x 3/4" sheet of plywood mounted to the wall and painted with two coats of ANSI 61 gray enamel on both sides and all edges. Each telephone backboard shall be provided with a #6 copper ground wire connecting it to the ground electrode system.
- E. Telephone Termination Cabinet (for outdoor service point): Install a 30"x 36"x 5"(minimum) NEMA 3R Telephone Termination Cabinet with hinged cover, integral covered splice compartment, and ¾" plywood back board equal to a Benner-Nawman #BN-30365 where indicated on the plans. Terminate the service conduit in the covered splice compartment and conduit from each tenant space in the telephone equipment compartment.
- F. Phone Service Raceway: Extend conduit of the size shown on drawings or as directed by the telephone company from the telephone backboard to the point of service as indicated or as directed by the telephone company (verify exact location with Utility Company).
 - For overhead telephone service, provide and install conduit with weatherhead as shown on drawing. Weatherhead shall be mounted (with extended mast if necessary) such that overhead service wiring shall be 10' above finish grade, 12' above drive and 18' above street. Provide 480# polypropylene pull line in each empty conduit.
 - 2. For underground telephone service, provide and install a minimum 2" underground conduit from the TBB to the utility pedestal or riser, as directed by Utility Company. Provide 480# polypropylene pull line in each empty conduit.

3.06. GROUNDING:

- A. Bond the neutral conductor and various conductive materials in the building per NEC Article 250.
- B. Grounding Electrode System: A bare copper grounding conductor shall be bonded to grounding electrodes as specified below. This conductor shall serve as ground for system neutral and for building equipment bonding. Where conductor is #6, or smaller, or is subject to injury, it shall be run in conduit, Schedule 80 PVC or Rigid Galvanized to which the conductor shall be bonded at both ends.
 - 1. Grounding electrodes shall be as follows:
 - a. Cold water piping, if metal and in direct contact with the earth for 10 feet or more, at the point of entry into the building. Grounding electrode shall be attached with UL approved bronze clamp.
 - b. Building structural steel, if present and accessible.
 - c. Grounding electrode shall be attached with exothermic weld connector.
 - d. Foundation reinforcing bar system. Coordinate with General Contractor to provide turned up re-bar (sleeved) near service point for attachment of grounding electrode above grade. Grounding electrode shall be attached with UL approved bronze clamp or exothermic weld connector.
 - e. Driven ground rod(s).
 - 1) Three 3/4" x 10' copper weld rods shall be driven into the ground at the lowest point adjacent to the building, spaced a minimum of 10' apart.
 - 2) Ground rods shall be driven to 12" below grade.
 - The grounding electrode conductor shall be attached to the rod(s) with UL approved bronze clamp or exothermic weld connector.
 - f. Existing grounding electrode system. If an existing electrical service is in place, it must be bonded to the new grounding electrode system.
- C. Connections to grounding rods, building structure, counterpoise, and conductor junctions shall be made by exothermic weld unless specifically noted otherwise.
- D. Electric system (neutral) ground: The current carrying neutral leg of the wiring system shall be of insulated conductor, and shall be connected to the grounding electrode conductor only via the neutral connection at the service equipment. Each branch circuit or multi-outlet branch circuit shall be provided with a dedicated neutral conductor.
- E. Equipment grounding conductors:
 - 1. An equipment grounding conductor (copper with green insulation except where bare copper is used) shall be provided in all wiring raceways.
 - 2. Sizes shall be in accordance with NEC 250.
 - 3. The equipment grounding conductor shall originate in the same panelboard, panelboard section, as the circuit conductors.
 - 4. The equipment grounding conductor bonding the sections of multi-section panelboards shall be sized per NEC 250.
 - 5. The equipment grounding conductor is not included in number of branch circuit conductors indicated on the drawings.
- F. Gas piping: Bond interior above grade gas piping to the grounding electrode.
- G. Telephone service ground: provide a minimum #6 bare, solid copper grounding conductor from the electrical service grounding connection to the TBB. Leave six (6) feet minimum of free conductor. Install the conductor in PVC conduit where inside the building.
- H. Computer backboard ground: provide a minimum #6 bare, solid copper grounding conductor from the electrical service grounding connection to the CBB. Leave six (6) feet minimum of free conductor. Install the conductor in PVC conduit where inside the building.
- Metal Lighting poles: Provide a grounding electrode at poles supporting outdoor lighting fixtures in addition to installing a separate equipment grounding conductor with supply branchcircuit conductors.
- J. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical

service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

- K. Grounding electrode resistance shall be less than 15 ohms. The resistance of the grounding electrode shall be tested by the Fall of Potential Method.
- L. Lighting Standards (Poles): Install 10' driven ground rod at each pole. On non-metallic poles, ground metallic components of lighting unit and foundations. Connect fixtures to grounding system with No. 6 AWG conductor.
- M. Each grounding conductors at the service entrance ground bus bar shall be provided with a brass round identifying tag. Tag shall indicate where ground wire is terminated.

3.07. EXCAVATION, CUTTING AND BACKFILLING:

- A. Provide cutting and patching, under the supervision of the General Contractor, as required for the work in Section 26.
- B. Locate all existing below grade and/or below floor utilities prior to beginning any site excavation or cutting of existing floor slabs. The Contractor shall repair any damage to existing utilities or systems.
- C. Saw cut existing concrete slabs and asphalt paving.
- D. Trenching:
 - 1. Dig trenches true to line, with a flat, even bottom.
 - 2. Width of the trench shall provide not less than 3 inches clearance from the conduit to each side of the trench.
 - 3. Insure that foundation walls and footings and adjacent load bearing soils are not disturbed in any way.
 - Conduits shall be installed below footings where possible. Where a line passes under a footing, make crossing with the smallest possible trench to accommodate the conduits/sleeves.
 - 5. Where a line must pass adjacent to and blow the bottom of a column footing, or the corner of a continuous footing, backfill the trench with concrete up to the level of the footing bottom, for a distance away from the footing equal to the depth of the fill.
 - 6. Keep excavation free from water, by pumping if necessary.
 - 7. Where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level to proper elevation with sand or earth free from particles that would be retained on a 1/4 inch sieve.
 - 8. Remove and relocate existing obstructions as directed.
 - 9. The Contractor shall be responsible for the repair and/or replacement of any damage to existing utilities, structure, or finishes.
 - 10. Coordinate work with other trades as work progresses so cutting and patching will be minimal.
 - 11. Refer to Section "Earthwork" for shoring, sub-soil assumptions and data, work around trees, surplus earth, etc.
- E. See Section 260100, "Conduit Installation, Below grade and below slab conduit installation", for installation of conduits in trenches.
- F. Backfilling:
 - Immediately after inspection, cover conduits with 3" of compacted sand or earth free from particles that would be retained on a 1/4 inch sieve. Do not to disturb the alignment or joints of the conduits.
 - 2. Carefully backfill with 4" of earth free from clods, brick, etc., firmly puddling and tamping.
 - Thereafter, puddle and tamp every vertical 4" for hand tamping or 8" for heavy duty mechanical tamping.
 - 4. Backfill shall meet the compaction requirements set forth in Division 2.
 - Backfilling Beneath Slabs and Pavement: Trenches beneath future slabs or pavement, including but not limited to buildings, drives, parking areas, sidewalks, playground surfaces, and equipment pads, shall be backfilled, from 3" above top of conduits to final

grade, with crushed aggregate, AHD 825, type B, compacted in 4" layers to 100% ASTM 698.

6. Install marking tape above conduits at 12 inches below grade.

3.08. SLEEVES, INSERTS, AND SUPPORTS:

- A. Provide and install No. 16 gauge galvanized steel or iron sleeves in all walls, floors, ceilings, and partitions. Sleeves shall have no more than 1/2" clearance around pipes and insulation.
- B. The contractor shall furnish to other responsible trades all sleeves, inserts, anchors and other required items which are to be built in by other trades for securing of all hangers or other supports by the Contractor.
- C. The contractor shall assume all responsibility for the placing and sizing of all sleeves, inserts, etc., and shall either directly supervise or give explicit instructions to other trades for their installation.
- D. The contractor shall seal all conduits through floors, smoke partitions, and floor partitions, with a sealant approved for the application.
- E. All sleeves through sound barrier walls and partitions shall be sealed with mineral wool.
- F. Through the floor conduit penetrations shall be sealed watertight.
- G. Furnish and install steel angles and channels as required for mounting and bracing heavy equipment and conduits. Steel shall be securely bolted or welded to structure and equipment bolted to the steel framework. Obtain the approval of the Architect prior to welding.

3.09. BELOW GRADE THRU WALL WATER SEALS:

- A. Each conduit penetrating exterior, below grade, cast cncrete walls shall have the annular space aroung the conduit sealed with an approved Thru Wall Water Seal System.
- B. Where the system includes water seal thru wall sleeves, the Electrical shall provide properly sized sleeves to the contractor responsible for constructing the walls and shall be responsible for the proper location of each sleeve.
- C. Where openings are to be core drilled, the Electrical Contractor shall be responsible for the core drilling and for coordinating proper sizing and location of each opening.

3.10. FIRE STOPPING:

- A. The Electrical Contractor shall be responsible for firestopping of all penetrations of fire rated partitions made by any and all lighting, power, and auxiliary circuiting, sleeves and/or equipment.
- B. The Electrical Contractor shall submit manufacturers' UL System drawings for the systems to be utilized. The systems shall be compatible with the partition ratings as indicated on the Architectural drawings and in accordance with details on the Electrical drawings.
- C. Penetrations of fire rated partitions shall be sealed with an approved fire sealant resulting in the completed penetration having the same fire rating as the partition.
- D. The installation shall be in accordance with the manufacturer's UL system detail and installation instructions to attain the required fire partition rating.
- E. Empty sleeves through 1 and 2 hour rated partitions shall be plugged with mineral wool.
- F. Sleeves through 4 hour rated partitions shall be plugged with mineral wool and fire stopping material.

3.11. ROOF PENETRATIONS:

A. Furnish roof flashing for all equipment, installed under Section 26, which penetrates through the roof. Flashing shall be approved by the Architect prior to installation.

3.12. CONDUIT INSTALLATION:

- A. Conduits shall be as follows:
 - 1. Overhead Service Entrance Rigid Galvanized Steel (RGS) Conduit or IMC.
 - Underground Service Laterals: Schedule 40 rigid PVC in horizontal runs with rigid galvanized steel elbows turning up to vertical RGS.

- 3. Where subject to moisture or mechanical injury RGS conduit.
- ALL conduits exposed to moisture or subject to mechanical damage shall be RGS. Where
 conduit exits building, the changeover from EMT to rigid shall be inside exterior wall.
- 5. In open shop and industrial installations RGS shall be run to 10' A.F.F.
- 6. All conduit exposed on the outside of the building envelope shall be Rigid Galvanized
- Steel (RGS) conduit. This includes all conduits on and/or under canopies or awnings.
- In concrete or solid masonry RGS conduit
 Above furred spaces or in cells of hollow masonry EMT
- Concealed inside drywall construction walls and above lay-in ceilings EMT.
- 10. Exposed conduits:
 - a. Conduits installed exposed in shop, warehouse, and manufacturing areas shall be RGS up to 12' A.F.F. Conduits in such spaces above 12' A.F.F. may be EMT unless indicated otherwise on the drawings.
 - b. Exposed indoors in non-hazardous unfinished areas not subject to physical damage $\mathsf{E}\mathsf{M}\mathsf{T}$
 - c. Exposed in kitchen and dishwashing areas: Rigid aluminum.
- 11. Branch circuits in slab (3/4") PVC. Turn up through slab with RGS ells no exceptions. Extend rigid turn-ups 2" minimum above finish floor level.
- Circuits beneath building vapor barrier PVC. Turn up through slab with RGS ells no exceptions. All elbows 45° and greater shall be RGS. Extend RGS turn-ups 2" minimum above finish floor level.
- 13. Below Grade PVC with RGS, or rigid aluminum where applicable, elbows turning up to vertical. All below grade elbows 45° and greater shall be RGS.
- 14. Motor, HVAC equipment, and vibrating equipment connections flexible metal conduit, liquid tight flexible metal conduit outdoors, in kitchen and dishwashing area, or in other wet areas. Liquidtight flexible nonmetallic conduit shall be used only where specifically indicated.
- 15. IMC may be used where RGS is indicated.
- B. Conduit sizes:
 - 1. Unless specifically indicated otherwise herein or on the drawings, the minimum conduit size shall be 3/4".
 - a. All conduits installed below grade or below slab shall be 3/4" minimum.
 - b. The minimum size for flexible lighting fixture "whips" shall be 3/8" and the maximum length shall be 6 feet. Lighting fixture "whips" shall be defined as flexible conduits with conductors feeding one or more recessed lighting fixtures installed in suspended, lay-in, acoustical ceiling systems from a single junction box.
 - c. ½" conduit may be for final connections to equipment or fixtures where conduit is less than three (3) feet in length and is extended from a junction box or from a ¼" conduit stub up.
 - Conduits shall be sized in accordance with the National Electrical Code as adopted by the local authority having jurisdiction or as amended to date, except where a larger size is indicated on the drawings or specified herein.
- C. Layout:
 - Generally follow the conduit layout shown on the drawings. However, the layout is diagrammatic only and must be adjusted for structural conditions, built-in equipment and other factors. Offsets are not indicated and must be furnished as required.
 - Install all conduits concealed except in equipment rooms and where exposed runs are specifically indicated.
 - 3. Install conduit runs to avoid proximity to steam or hot water pipes. In no place shall a conduit be run within 6" of such pipes except where crossings are unavoidable, then conduit shall be kept at least 1" from the covering of the pipe crossed.
 - 4. Eliminate trapped runs insofar as possible.
 - 5. Do not chase new work, but instead build in conduit as work progresses.
 - 6. Do not run conduit in cavity of exterior walls.

- 7. Run concealed conduits in direct line with long sweep bends and offsets where practicable.
- Install exposed conduit with runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings, with right-angle turns consisting of cast-metal fittings or symmetrical bends.
- 9. Where conduits are indicated exposed overhead, runs down to wall outlets shall be concealed in wall.
- D. Conduit Installation:
 - 1. Securely fasten conduits to all sheet metal outlets, cabinets, junction and pull boxes with locknuts and bushings, taking care to see that stout mechanical and solid electrical connections are obtained.
 - All conduits shall have bushings with smooth beveled throats installed at both ends prior to installing conductors. Split bushings around conductors shall be taken to indicate that the conductors were pulled into conduit without the proper bushings installed and a basis for requiring the replacing of the conductors.
 - Conduits entering service enclosures (panelboards, disconnect switches, switchboards, motor control centers, etc. used as service entrance equipment) shall be provided with specification grade, insulating, grounding type bushings. Grounding bushing shall be bonded together and bonded to the service grounding buss.
 - 4. Support:
 - a. Raceways shall be securely and rigidly supported to the building structure in a neat and workmanlike manner, and wherever possible, parallel runs or horizontal conduit shall be grouped together on adjustable trapeze hangers.
 - b. Support shall be provided at appropriate intervals <u>not</u> exceeding eight(8) feet with straps, hangers, and brackets specifically designed for the application.
 - c. Channels shall be 1 inch for 18-inch wide trapeze, 1-3/8 inch for 24 to 30 inch, and 1-5/8 inch for over 30 inch wide trapeze.
 - d. Perforated steel straphangers, "butterfly clips", or tie-wire supports are not acceptable.
 - e. Conduits shall not be supported from ceiling support wires.
 - f. Conduits installed along wall surfaces shall be supported with galvanized steel brackets specifically designed for conduits and sized for the conduit used.
 - g. PVC conduits shall be supported per the NEC with PVC or stainless clamps and stainless steel hardware.
 - h. Attach to supporting devices with screws, bolts, expansion sleeves or other workmanlike means appropriate to the surface.
 - i. In stud walls, anchors shall be completely rattle proof.
 - j. For conduits in damp and wet locations, use stainless steel clamps and stand-offs, or galvanized malleable or cast iron clamps and spacers.
 - k. All mounting hardware for aluminum conduit shall be stainless steel.
 - I. Surface mounted conduits installed in kitchen and dishwashing areas shall be supported off walls approximately 3/16".
 - 5. Thread rigid conduits so that the ends meet in couplings; cut ends square, ream smooth and draw up tight.
 - 6. All field cut threads shall be cleaned with a solvent such as mineral spirits and painted with two coats of galvanize primer.
 - 7. Cap conduit ends to keep out water and trash during construction.
 - 8. Field made bends:
 - a. Avoid field-made bends where possible, but where necessary, use a proper hickey or conduit-bending machine.
 - b. Field made bends in PVC conduit shall be made with a heated PVC conduit bender.
 - c. Make no bends with radius less than six times the conduit diameter, nor more than 90 degrees.
 - 9. Make changes in direction with pull boxes, symmetrical bends and/or cast-metal fittings.
 - 10. Total bends in any conduit run shall not exceed the equivalent of four, quarter (90°) bends for a total of 360°, per NEC, between pull boxes.
 - 11. Replace any crushed or deformed conduits.

- 12. Conduits passing through roofs shall be in place before roof is installed.
- Conduits installed in concrete/grout filled CMU walls shall be Rigid steel or IMC conduits installed field wrapped with 0.010 inch thick pipe-wrapping plastic tape applied with a 50 percent overlay. Painted on coating shall not be acceptable.
- 14. Where conduits pass through or across building expansion joints, provide hot-dipped galvanized expansion fittings with bonding jumpers.
- 15. Insure that all penetrations of firewalls are sealed per NEC and IBCC.
- 16. Right and left couplings shall not be used; conduit couplings of the Erikson type shall be used at location requiring such joints.
- 17. Paint all conduits exposed in finished spaces. Paint shall consist of one coat of zinc rich primer plus two top coats of water-based latex paint, color to match adjacent finishes. Verify colors and paint system with Architect.
- 18. All conduit runs entering the building from outdoors shall be sealed against moisture migration and condensation by filling with insulating type foam.
- 19. All conduits passing through walls of coolers or freezers shall have seal fitting installed on the outside of the cooler/freezer wall and within 3" of the wall. Fitting shall be sealed per manufacturer's recommendations.
- 20. Install telephone, data, intercom, and signal system raceways, 2-inch trade size and smaller, in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.
- E. Below grade and below slab conduit installation:
 - 1. See Section 260100, "Excavation, Cutting, and Backfilling" for trenching and backfilling requirements.
 - 2. Rigid steel or IMC conduits installed below slab-on-grade or in the earth shall be field wrapped with 0.010 inch thick pipe-wrapping plastic tape applied with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system. Painted on coatings shall not be acceptable. Wrap shall extend a minimum of 1" above slabs or 3" above finished grade where there is no slab. Alternate methods must approved by Engineer prior to bids.
 - 3. Top of the conduit shall be not less than 30 inches below grade.
 - 4. Run conduit in straight lines except where a change of direction is necessary.
 - Conduits stubbed up from below grade or slab into exterior walls shall be turned toward the interior of the building below slab fill perpendicular to the wall. Conduits shall not be turned out toward the exterior unless specifically indicated to do so.
 - 6. Placing of conduits below slab on grade:
 - a. Conduits 1-1/4" and larger shall be installed a minimum of 12" below the bottom of slab in the clay/sand fill below any gravel fill material.
 - b. Conduits 1" and smaller may be installed in the porous/gravel fill below the vapor barrier.
 - 7. Multiple Conduits:
 - a. Separate multiple conduits by a minimum distance of 2-1/2 inches horizontally and 3 inches vertically, except that light and power conduits shall be separated from control, signal, and telephone conduits by a minimum distance of 3 inches horizontally and vertically.
 - b. Where multiple layers of conduits are to be placed in a trench, each layer shall be placed in the trench, straight and parallel, clear fill material (see Excavation, Cutting, and Backfilling) placed and tamped in place to provide the specified spacing, and each subsequent layer placed in the same manner.
 - c. Stagger the joints of the conduits by rows and layers to strengthen the conduit assembly.
 - d. Conduits shall not be placed haphazardly in the trench.
 - 8. Where conduits pass through footings or foundation walls:
 - a. Conduits roughed in beneath slab shall exit the foundation perpendicular to the building spaced approximately 3" apart. Conduits shall be arranged in a single horizontal row where practical.

- b. Secure approval from the Architect and Structural Engineer prior to penetrating any footing or foundation wall.
- c. Schedule 40 PVC sleeves shall be cast in the footings or foundation wall for the conduits to pass through.
- d. Multiple sleeves shall have 3" clearance, vertically and horizontally, between the sleeves unless directed otherwise by the Architect and/or Structural Engineer.
- 9. Where PVC conduit is installed below grade a PVC to rigid metallic conduit coupling shall be installed in the horizontal run and a rigid galvanized steel conduit elbow installed to turn up to above grade. Where above grade conduits are indicated to be rigid aluminum the elbow turning up to vertical shall be rigid aluminum.
- 10. Rigid aluminum conduit shall be wrapped same as RGS through concrete from 2" each side of the concrete.
- 11. Rigid galvanized conduit shall extend a minimum of 6" above the finished floor level.
- 12. In hazardous areas the coupling shall be below grade and a single section of conduit installed up to 18" A.F.F. to accept the required seal fitting.
- Wiring shall be extended in rigid threaded conduit to equipment, except that where required, flexible conduit may be used from 6 inches above the floor to the served equipment.
- 14. Conduits shall exit concrete slabs vertically.
 - a. Where adequate support cannot be obtained by wiring to reinforcing steel, obtain support with solid iron stakes (which may be driven through membrane) cut off flush with slab after pouring.
 - b. At turn-ups of adjacent runs of exposed conduit, obtain alignment by wiring members to a temporary horizontal member.
- 15. Empty or spare conduit stub-ups shall be capped with a threaded cap.
- 16. Encasement Under Roads, Structures, and at other locations indicated on the drawings:
 - a. Under roads, paved areas, railroad tracks, and other locations indicated on the plans install conduits in concrete encasement of rectangular cross-section providing a minimum of 3 inch concrete cover around ducts.
 - c. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assemblies shall consist of base spacers, intermediate spacers, and top spacers to provide a completely enclosed and locked-in conduit assembly.
 - d. Install #4 rebar at each corner of the encasement and at not more than 18" on center vertically and horizontally on the sides of the encasement. #4 rebar hoops shall be installed at not more than 18" on center along the length of the encasement.
 - e. Concrete encasement shall extend at least 5 feet beyond the edges of paved areas and roads, and 12 feet beyond the rails on each side of railroad tracks.
- Conduits to be installed under existing paved areas, which are not to be disturbed, and under roads and railroad tracks, shall be installed through a zinc coated, rigid steel, sleeve, jacked into place.
- Conduits installed between handholes, manholes or other accessible areas shall have a minimum slope of 3 inches in each 100 feet away from buildings and toward manholes and other necessary drainage points.
- 19. The contractor shall provide properly rated and sized junction and pull boxes as required on all underground conduit runs 150 feet and greater so as to minimize pulling tensions on cables to be installed in conduits. In no case shall pull or junction boxes be further than 300 feet apart. Provide pulling tension calculations on all underground runs over 200 feet as required in Paragraph 1.09 Submittals.
- F. Conduit Installation in concrete slabs:
 - Conduit installed in concrete slabs shall be rigid steel or IMC. Rigid steel or IMC conduits installed in slabs-on-grade shall be field wrapped with 0.010 inch thick pipe-wrapping plastic tape applied with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system. Painted on coatings shall not be acceptable.
 - At slabs on grade, conduit, 3/4" maximum, may be run in the slab; larger conduit shall be run below slab.

- Where adequate support cannot be obtained by wiring to reinforcing steel, obtain support with solid iron stakes (which may be driven through membrane) cut off flush with slab after pouring.
- 4. At turn-ups of adjacent runs of exposed conduit, obtain alignment by wiring members to a temporary horizontal member.
- G. Flexible conduit:
 - 1. At motor or equipment connections:
 - The maximum length allowable for flexible conduit shall be 36 inches except at lighting fixtures.
 - b. Flexible conduit installed outdoors shall be installed so as to provide an 8 inch minimum drip loop as measured from the lowest end of the conduit.
 - 2. At lighting fixture connections provide flexible steel conduit by one of the manufacturers named for rigid.
 - a. Maximum length allowable shall be 72 inches.
 - b. Support flexible conduit such that it does not contact the ceiling system, ductwork, or other equipment above the ceiling. The conduit shall not be attached to a ceiling or ceiling support system.
 - c. All fixture whips shall be supported within 12" of outlet/junction boxes with single hole clamps.
- H. Empty conduit:
 - 1. Install a #14 galvanized fish wire or polypropylene pull cord with 14-inch free ends in all empty power and/or auxiliary conduits.
 - 2. All conduits indicated to be terminated above the ceiling shall have an elbow turned out above the ceiling and shall be terminated with an insulating bushing.
 - 3. Empty conduits stubbed out of buildings below grade:
 - Empty conduits stubbed out of buildings below grade shall extend 5 feet outside of the building foundation.
 - Install a 12"x 12"x 6" concrete marker at grade, above the end of the conduits, with "ELEC" inscribed on top.
 - f. Note on as-built drawings the exact location where empty conduit(s) are stubbed out below grade to the building exterior. Indicate conduit sizes and number of each size.
 - g. The contractor shall provide properly rated and sized junction and pull boxes as required on all underground conduit runs 150 feet and greater. In no case shall pull or junction boxes be further than 200 feet apart.
- I. Conduit entries into enclosures, panelboards, and wiring troughs:
 - 1. Layout conduit entries carefully to allow clearances for the number and sizes of conduits, electrical equipment, and future expansion.
 - 2. In sheet metal equipment use Greenlee Knock-Out punch, or equal, to cut holes for conduit installation. Do not drill holes, or cut holes out with snips or torch.
 - 3. In cast enclosures and boxes drill conduit openings with correct size drill for tight fit.
- J. All junction box covers above the ceiling shall be labeled to which circuits or systems they contain.

3.13. CONDUIT BODIES:

- A. Conduit bodies shall be sized in accordance with NEC 370, and 373.
 - Conduit bodies for conductor sizes AWG #4 and larger shall be mogul type bodies sized in accordance with NEC 370-28.
 - Conduit bodies for conductor sizes AWG #6 and smaller shall be sized in accordance with NEC 370-16(c).

3.14. JUNCTION AND PULL BOXES:

- A. Junction and pull boxes shall be sized per NEC to accommodate the installed number and size of conductors and conduits.
- B. Boxes shall be securely fastened in place.

- C. Boxes serving lighting fixtures installed in accessible, suspended ceilings:
 - 1. Provide number of boxes as required to maintain fixture whips within the 6' maximum length.
 - 2. Generally attach to underside of structure above, in accessible location, to accommodate a maximum 6' flexible conduit connection to each fixture or fixture run.
 - 3. Where the structure above is more than 18" above the ceiling the boxes shall be supported within 18 inches of the ceiling with all thread rod and/or strut.
- D. Install galvanized steel utility box plates, by box manufacturer, at exposed conduit fittings or boxes.
- E. All junction box covers above the ceiling shall be labeled to which circuits or systems they contain.

3.15. WIRE AND CABLE INSTALLATION:

- A. No conductor shall be smaller than #12 except where so designated on the drawings or specified elsewhere.
- B. Multiwire lighting branch circuits shall be used where indicated.
- C. Wiring devices shall be connected such that each device can be removed without interrupting the neutral or equipment grounding conductors serving other outlets on the same circuit(s).
- D. Joints and splices in wire shall be made with solderless connectors, and covered so that insulation is equal to conductor insulation. Wire nuts shall not be used for conductor #8 and larger.
- E. No splices shall be pulled into conduit.
- F. Both conductors and conduit shall be continuous from outlet to outlet.
- G. No conductor shall be pulled into the conduit until the conduit is cleaned of all foreign matter.
- H. When installing parallel conductors, it is mandatory that all conductors making up the feeder be exactly the same length, the same size, and type of conductor with the same insulation. Each group of conductors making up a phase or neutral must be bonded together at both ends in an approved manner.
- I. MC cable or Romex cable will note be accepted unless specifically called for on drawings.
- J. Wiring thru light fixtures and receptacles will not be accepted.

3.16. AUXILIARY GUTTERS (WIRING TROUGHS):

- A. Auxiliary Gutters shall be sized per NEC to accommodate the installed number, size, and orientation of conductors and conduits.
- B. Conductors serving a gutter shall be extended without reduction in size, for the entire length of the gutter.
- C. All taps and splices shall be made with insulated multi-tap connectors.

3.17. CIRCUITS AND BRANCH CIRCUITS:

A. Outlets shall be connected to branch circuits as indicated on the drawings by circuit number adjacent to outlet symbols, and no more outlets than are indicated shall be connected to a circuit.

3.18. WIRE JOINTS:

- A. Except for motor circuits, wire joints for #8 and smaller wire shall be made with twist on connectors.
- B. Wire joints and splices for motor circuits, for conductors #6 and larger, and for smaller conductors where other connectors are not rated for the number of conductors involved shall be made with split bolt connectors rated for the applicable conductor size, number of conductors, and conductor material.
 - 1. Properly tape and insulate all joints to attain the same insulation rating as the cable insulation.

- 2. Splices for #6 through #1 shall have a minimum or two (2) layers of rubber tape covered by a minimum of three (3) layers of electrical tape.
- 3. Splices for #1/0 and larger conductors shall have a minimum of two (2) layers of electrical filler tape covered by a minimum of three (3) layers of electrical tape.
- C. Splices in control conductors shall be avoided as much as possible. Stranded control conductor up to #12 may be connected or spliced with hand crimped type compression connectors. The connectors shall be of the proper size for the conductors being connected.
- D. Splices and joints made with mechanical/hydraulic type compression connectors:
 - 1. Connections and splices shall be made with connectors rated for the applicable conductor size and conductor material.
 - Dies used shall leave the die number embossed in the connector. The Contractor shall provide the Engineer with the Manufacturer's connector and die chart prior to final inspection.
- E. Taps and splices in auxiliary gutters/troughs shall be made with insulated multi-tap connectors.
- F. Wire joints and splices made below grade shall be made with UL listed waterproof connectors, wire nuts, or splice kits.
- G. All joints and splices shall be made in junction boxes, wiring troughs, or conduit bodies sized per NEC.
- H. All connections to switchboards, panelboards, transformers, generators, ATS, or any other type electrical distribution type equipment shall be compression type fittings. Mechanical fittings will not be accepted in these applications.

3.19. STRUT SYSTEM FOR SUPPORT OF ELECTRICAL EQUIPMENT:

- A. Strut Systems: Strut shall be utilized to rack exposed piping vertically or horizontally on walls and across slabs (where applicable). Strut may be utilized to support piping above ceilings, for support of equipment, and elsewhere as deemed appropriate.
 - 1. Strut in conditioned spaces and above accessible ceilings shall be electro-galvanized.
 - 2. Strut installed outdoors, in mechanical rooms, and in other unconditioned spaces shall be hot-dipped galvanized.
 - 3. Strut installed in waste water treatment facilities, kitchens, dishwashing spaces, and labs shall be stainless steel.
 - 4. Strut fittings and hardware, including anchors, shall be same material as strut.
 - 5. Saw cut strut square, 6" minimum lengths. Strut on continuous runs of pipe shall be same length. File or grind burrs from saw cuts.
 - 6. After installation, electro-galvanized and hot-dipped galvanized strut shall be painted with two coats of zinc primer.

3.20. OUTLET BOX INSTALLATION:

- A. General: The drawings indicate approximate locations only; determine the exact location at the building in view of all structural and architectural conditions. Obtain Architect's verification of final locations.
- B. Outlet boxes shall be sized per NEC to accommodate the installed number and size of conductors, wiring devices, and conduits.
- C. Ceiling and Wall Bracket Outlets: 4" octagonal boxes with plaster rings appropriate for finish surface.
- D. Typical boxes (for switches, receptacles and auxiliary systems): 4" square boxes ganged as required. Furnish with 3/4" plaster rings where employed in plaster, 1" tile covers where used in ceramic tile, 1" plaster rings where set in exposed concrete, and otherwise appropriate for surface and construction.
- E. Boxes in Exposed (or Thin-Coat Plastered) Masonry: Where conduit connections permit, employ solid flush-type, square-cornered, masonry boxes with turned-in device holders; otherwise employ typical box with 1-1/2" square-cut tile cover. .
- F. Multiple Outlet Floor Boxes:

- 1. Verify the exact location of the floor boxes with the Architect prior to rough-in.
- 2. Set the boxes in accordance with the manufacturer's instructions.
- Boxes shall be set so that the box is flush with the finished floor; the boxes shall not cause a rise or fall in the floor.
- 4. The power outlets shall be connected to the circuits indicated by the numbers next to the symbol.
- 5. For Data outlets, install a 1" C. to above the nearest corridor ceiling.
- G. Boxes used with Exposed Conduit: 4" square utility boxes.
- H. Exterior Boxes: Cast-metal boxes, Crouse-Hinds Type FS or FD as appropriate. Make weatherproof with gasketed covers. Equal products by Appleton, Killark, O-Z/Gedney, or approved equal will be accepted.
- I. Boxes used with Recessed Lighting Fixtures in suspended acoustical tile ceilings:
 - 1. Provide a 4" square box with blank cover adjacent to each fixture or fixture group.
 - 2. Install a flexible metal conduit fixture "whip" from the box to the fixtures. The "whip" shall not be longer than 72".
 - 3. Attach the box to the underside of the structure above, in an accessible location, not more than 18" above the lay-in ceiling.
 - Where structure is more than 18" above the ceiling, the boxes shall be supported from allthread rods, strut, or a combination of rod and strut.
- J. Boxes in Dry Wall Construction:
 - 1. Outlet boxes shall be securely fastened in place.
 - Outlet boxes installed in metal stud construction shall be supported by brackets screwed to studs. Clip on brackets shall not be accepted.
 - a. Where a single outlet box is installed adjacent to a stud, brackets may attach to a single stud with a brace against the back of the opposite wall. Use a bracket equal to Caddy Fasteners "H" Series.
 - b. Where outlets do not fall next to a stud or where more than one outlet is installed between studs use a metal bracket attached to both studs. Brackets shall be equal to Caddy Fasteners "SGB", "TSGB", or "RBS" series brackets.
 - c. Outlet boxes three gangs and wider shall be supported with support member screwed to the two adjacent studs. Brackets equal to Caddy Fasteners SGB or TSGB brackets may be used.
- K. Sectional type switch boxes at least 2-1/2" deep may be used instead of typical box (but not where dry wall finish is applied over masonry back-up and not where multi- gang devices occur).
- L. Outlets in unfinished masonry walls may be slightly adjusted upward or downward to suit masonry courses, provided outlets are mounted at uniform heights throughout the installation.
- M. Coordinate installation of outlet boxes in masonry walls with the masonry contractor to insure that boxes are flush with face of wall and grouted smooth around boxes such that covers, fixtures or devices install flush on face of wall.
- N. Where outlets at different levels are shown adjacent, install in one vertical line where possible. Avoid conflict with wainscot caps, splash backs and upper cabinets by adjusting height slightly up or down as directed.
- O. Back to back boxes shall be staggered with at least 3 inches between boxes.
- P. Back to back boxes in fire rated partitions shall have a minimum of 24" horizontal and/or vertical separation between them.
- Q. Backs of boxes three gang and larger installed in fire rated partitions shall be wrapped with self adhesive fire stopping tape.
- R. Locate switch outlets on the lock side of doors and so that the first switch in a single or gang installation is approximately 6" to 10" from the doorjamb. Verify door swings on Architectural Drawings.

- S. Dimmers shall be ganged together in accordance with the manufacturer's instructions where appropriate, but shall not be ganged with toggle switches.
- T. Coordinate carefully with appropriate trades the size and orientation (vertical, horizontal) of outlet boxes for thermostats, data outlets, fire alarm equipment, security equipment, and other control and communications outlets.
- U. Mounting Heights:

Confirm all mounting height with local codes	and authorities prior to bid and adjust as required:
Switches, generally	48" A.F.F. to top of outlet
Safety switches	Center of Switch 48" A.F.F. or as required.
Receptacles, generally	16" A.F.F. to bottom of outlet
Receptacles over counters	Bottom of outlet 6" above countertops or 2" above backsplashes
Telephone Outlets	16" A.F.F. to bottom of outlet
Computer Outlets	16" A.F.F. to bottom of outlet
Television Outlets	16" A.F.F. to bottom of outlet or as indicated
Wall mounted exit and emergency lights	Bottom of fixture 7'- 6" A.F.F. or 12" below Ceiling whichever is lower
Thermostat	Top of outlet 48" A.F.F. or as noted by mechanical drawings.
Brass bell	Top of outlet 12" below ceiling, 8' maximum.
Electric Water Coolers	Coordinate location with plumbing contractor to locate the receptacle(s) concealed within the EWC enclosure per manufacturer's installation instructions.

- V. Install blank coverplates on all unused power and auxiliary outlet boxes. Blank coverplates shall match other cover plates installed in the facility.
- W. Furnish blank plates, matching those on the other outlets in the same area, on TV outlets and other outlets installed for future use.

3.21. WIRING DEVICES:

- A. Install wall devices vertically' unless otherwise noted, so that all devices of any given height will align exactly.
- B. Where boxes are not flush or square with the finished wall surface install wiring devices utilizing a leveler and retainer equal to Caddy #RLC or Steel City #SSF-SR.
- C. Plates shall be plumb and true with all four edges contacting wall surface.
- D. Mount receptacles with grounding terminals down.
- E. Do not install devices until plastering or other type wall covering has been completed; install ahead of painting work, but protect from paint spatter.
- F. Use screw terminal connections only.
- G. Do not gang dimmer switches with toggle switches.
- H. Each single or multi outlet receptacle, other than straight blade, 15 or 20 amp, 120 volts, NEMA 5-15R or NEMA 5-20R, shall be provided with matching cord plugs and a minimum of 8 feet of Type SOW cable matching the receptacle size and configuration.
- I. Pin and sleeve plugs for food service equipment shall be provided with a Type SOW cable connected to the equipment and plug of sufficient length to reach from the equipment to the plug with a minimum of 18" slack cork. Minimum length shall be 6 feet from equipment to plug.
- J. Provide "Kellums" type grips at the plug, cord connector, and for overhead support on all overhead cord connector drops.

3.22. OCCUPANCY SENSORS AND ASSOCIATED DEVICES FOR LIGHTING CONTROL:

A. Occupancy sensors and associated devices and circuiting shall be installed in strict accordance with the manufacturer's instructions.

- B. Wall, corner mounted sensors shall be mounted as close to the ceiling as possible on the manufacturer" corner mounting bracket.
- C. Power packs shall be mounted above the ceiling. Power packs shall be installed utilizing two(2) 4" x 4" x 2-1/8" deep boxes joined together using the nipple on the powerpack in accordance with the manufacturer's instructions. One of the boxes shall contain the power pack and control wiring and the other shall contain the power wiring.
- D. All control and power circuiting shall be in EMT conduit. Where the devices are not equipped with conduit connections the conduit shall be brought up as close as possible to the device and terminated with insulating bushings.

3.23. ELECTRICALLY POWERED EQUIPMENT AND CONTROLS:

- A. Provide and install power circuits for all electrically powered equipment and controls.
- B. Heating, Ventilating, and Air Conditioning Control Wiring and Conduit:
 - The electrical contractor shall be responsible for installing outlet boxes for flush mounted HVAC system thermostats in dry wall or masonry wall construction and, where called for on the plans, for surface mounted metallic receway in finished areas. Extend ¾" conduit from the outlet to above nearest accessible ceiling and terminate horizontally. Refer to the Mechanical/HVAC plans for thermostat locations and coordinate exact type outlet required and orientation with the Mechanical/HVAC contractor.
 - The Mechanical Contractor shall be responsible for the installation of all outlets and conduit for surface mounted devices in unfinished areas such as shops, warehouses, industrial facilities, etc.
 - 3. The mechanical contractor shall furnish and install all low and line voltage control wiring required for the temperature control and/or ventilation systems.
- C. Where Fire Alarm system duct mounted smoke detectors and HVAC shut down interface relays are provided, the Electrical contractor shall provide wiring from the smoke detectors to the HVAC shut down interface relay. All circuiting from the shut down relay to the HVAC controls and/or starters shall be provided and installed by the Mechanical/Controls contractor.
- D. The mechanical contractor shall furnish all motor starters for the temperature control and/or ventilation equipment unless otherwise indicated on the electrical plans or elsewhere in these electrical specifications. The electrical contractor shall install all motor starters, except for equipment with factory installed starters, for the temperature control and/or ventilation equipment.
- E. Where exhaust fans are supplied with field installed speed controllers, the Electrical Contractor shall provide all necessary circuiting to the fan/speed controller and between the fan and the speed controller.

3.24. DISCONNECTING MEANS:

- A. Where required by the National Electrical Code and/or other applicable codes or authorities, or where indicated on the electrical plans, the electrical contractor shall furnish and install an approved disconnecting means for all electrically powered equipment and/or controllers for such equipment whether the disconnecting means is or is not shown on the electrical plans.
 - 1. The location, rating, and enclosure for the disconnecting means shall be as required by the National Electrical Code and/or other applicable codes or authorities.
 - 2. Manual motor starters with thermal overload protection may be used in lieu of safety switches for individual motors under 1 horsepower.
 - 3. Motor rated switches may be used for the disconnecting means when supplied of correct voltage, phase, amperage rating, and enclosure type.
 - 4. The disconnecting means shall be as manufactured by General Electric, Square D, Cutler Hammer, or Siemens.
- B. Where the disconnecting means shown on the electrical plans has a rating greater than the required code rating, the greater rating device shall be installed.

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- C. An approved horsepower rated fusible safety switch shall be installed where the circuit overcurrent protection does not provide overload protection for the equipment served and where required to meet the equipment's listing requirements.
- D. Motor rated switches may be used as service disconnect switches when supplied with a padlockable, handle locking guard.
- E. Install an engraved phenolic nameplate on the front of each switch enclosure identifying the equipment served by the safety switch and source of power (i.e., panel name and circuit number). Plates shall be white with black lettering. The plates shall be permanently installed with stainless steel screws or stainless steel rivets.
- F. All disconnects installed in public areas or in areas readily accessible to the public shall be lockable and shall be furnished with a brass lock. Provide 10 keys for each lock. All disconnect locks furnished on the project shall be keyed alike.

3.25. LIGHTING FIXTURES:

- A. The installation and support of all lighting fixtures shall be the responsibility of the Electrical Contractor.
- B. Lay out work as shown, and to provide attractive and efficient arrangement.
- C. Install fixtures level, plumb, and true with ceiling and walls, and in alignment with adjacent lighting fixtures.
- D. Provide adequate and substantial supports for fixtures in accordance with manufacturers' directions and as specified herein.
- E. A Re-lock system will not be accepted for installing lights.
- F. Wire grid mounted luminaries individually to junction boxes with flexible conduit not more than 6 feet in length. Individual flexible connections shall be 2 #14 and 1 #14 ground THHN in 3/8" flexible conduit. Ground wire shall be bonded at each end.
- G. Fluorescent fixtures with "U" lamps and fixtures with PL fluorescent lamps shall have all fixtures in a room installed with the lamps oriented in the same direction.
- H. Fixtures mounted in inverted "T" grids:
 - 1. For round fixtures or fixtures smaller in size than the ceiling grid, provide a minimum of four wires per fixture located within 4 inches of each corner of the ceiling grid in which the fixture is located. Do not support fixtures by ceiling acoustical panels. Fixtures shall be supported independent of the ceiling system or shall be supported by at least two metal channels spanning the grid system, and secured to, the ceiling tees. One support wire shall be attached to the center of the fixture or to each of the metal channels.
 - 2. Surface mounted fixtures:
 - a. Surface mounted fixtures installed on lay-in ceiling systems shall be supported independent of the ceiling system form the building structure with a minimum of two (2) 3/8", minimum, all-thread rods.
 - b. Install nuts and washers on inside and outside of the fixture housing to provide a rigid installation.
 - c. Provide cross bracing as required such that fixtures have no lateral movement.
- I. All stems on fluorescent fixtures shall be installed as follows: (except fixtures with slide grip hangers) first and last stem in row in first knockout from end of fixture. One stem shall be installed between each two fixtures, stem shall center joint, where fixtures join, and attach by use of "jointing plates". Nipples with lock nuts and bushings shall connect all fixtures in continuous rows other than recessed grid type.
- J. All suspended lighting fixtures shall be provided with chain or cable sway bracing to keep fixtures from swinging.
- K. Fixtures installed in fire rated assemblies shall be tented in accordance with the specified assembly.
- L. Means shall be provided to keep insulation 4" minimum away from fixtures not rated for direct contact with insulation.

- M. Prior to final inspection clean fixtures and lamps with a soft cloth or sponge and detergent (not soap) solution.
- N. All fluorescent, induction or HID lighting fixtures installed in gymnasiums, hangars, high bay or similar use areas shall be equipped with wire guards.
- O. All emergency and exit lights designated on drawings shall be provided with an 1100-lumen battery ballast.
- P. All light fixtures shall be supported to the structure independent of the ceiling system on two opposite sides. Support wires shall be different color from ceiling support wires. Engage all ceiling mounting clips. If light fixture is not provided with grid support clips, then the contractor will be responsible to support the fixture on all four sides with support wires. See "Typical Lay-In Luminaire Detail" on drawings for further requirements.

3.26. STEEL(ALUMINUM) POLE SETTING:

- A. Bases for poles shall be constructed as detailed on the drawings
- B. Anchor bolts shall be set plumb and centered in the base with adequate threads left exposed for base plate, backing nuts, washers, and locking nut.
- C. Poles shall be set plumb. Adjust backing and locking nuts to plumb pole with pole base held as close to concrete bas as possible.
- D. Grout space between pole base plate and concrete base with non shrinking grout to provide a smooth finish.
- E. Smooth all nicks, scratches and scrapes and recoat with factory supplied or recommended primer coat and finish coat.

3.27. PANELBOARDS:

- A. Panelboards shall be installed where shown on the drawings.
- B. Ratings and configurations shall be as scheduled and/or indicated on the drawings.
- C. The Electrical Contractor shall coordinate installation of equipment in Electrical and Electrical/Mechanical spaces with other trades such that Code required clearances and working space around the electrical equipment is maintained.
- D. Conduit termination:
 - 1. In general use panelboards with blank ends, without knockouts.
 - Layout conduit entries carefully to allow clearances for drywall or CMU wall thickness, and to accommodate the number and sizes of home run conduits and specified spare conduits.
 - 3. Use Greenlee Knock-Out punch, or equal, to cut holes in panelboard ends and/or sides for conduit installation. Do not drill holes, or cut holes out with snips or torch.
- E. Phase arrangement in panelboards shall be per the NEC, phase A, B, C from front to back, top to bottom, or left to right as viewed from the front.
- F. In Delta connected systems the "high" leg shall be the B phase and shall be clearly marked with an orange outer finish.
- G. Multi-Section Panelboards:
 - 1. Sub-feed conductors shall be the same size as the conductors feeding the main section.
 - 2. Circuiting originating in one section shall not pass through another section.
 - 3. Circuit conductors and grounding conductors shall originate in the same panelboard section.
 - A separate isolated grounding conductor shall be installed from the main section to the sub-feed section(s).
 - 5. Where the panelboard is rated for service entrance equipment the each sub-feed section shall have a separate isolated ground buss fed from the main section ground buss.
- H. Labeling:
 - 1. Each panelboard shall have an engraved phenolic plate permanently installed on the front of the panel with the panel name, current rating, and voltage rating.

- 2. Where there is more than one nominal voltage system the panel shall also have an engraved phenolic plate describing the means of identification used to identify the phase and system of each ungrounded conductor of the system served by the panel.
- 3. Plates shall be white with black lettering.
- 4. Panelboard circuit numbers shall be as indicated on the panelboard schedules.

3.28. PHOTOELECTRIC CELLS, TIMERS, AND CONTACTORS FOR LIGHTING CONTROL:

- A. Install time clocks where accessible.
- B. Install photoelectric cells so that lighting fixtures do not affect the cell.
- C. Adjust time clock(s) and photoelectric cells as required for proper operation.

3.29. IDENTIFICATION AND LABELING:

- A. Feeder Designation:
 - Non-ferrous identifying tags or pressure sensitive labels shall be securely fastened to all cables, feeders, and power circuits in vaults, pull boxes, manholes, switch gear and at termination of cables. Tags or labels shall be stamped or printed to correspond with markings on drawings so that feeder or cable number and phase can be readily identified.
 - 2. Where there is more than one nominal voltage system, each ungrounded system conductor shall be identified by phase and system wherever accessible per NEC. The means of identification shall be permanently posted at each branch-circuit panelboard.
- B. Color Coding of Conductors:
 - 3. The ungrounded (phase) conductors and the grounded (neutral) conductors of each voltage system shall be identified by the following color coding method:
 - a. 120/240 Volts, Single Phase, 3 Wire:
 - 1) Grounded (Neutral) Conductor --- White
 - 2) Ungrounded (Phase) Conductors --- Red, Black
 - b. 120/240 Volts, Three Phase, 4 wire:
 - 1) Grounded (Neutral) Conductor --- White
 - 2) Ungrounded (Phase) Conductors --- Red, Orange, Black
 - c. 120/208 Volts, 3 Phase, 4 Wire:
 - 1) Grounded (neutral) Conductor --- White
 - 2) Ungrounded (phase) Conductors --- Black, Blue, Red
 - 4. Green shall be used for equipment grounding conductors only.
 - 5. The insulation color shall be visible for the entire length of wire.
- C. Panelboard:
 - 1. Each Lighting and Power Panelboard shall contain a typed circuit directory listing all circuit breakers and the load served by each.
 - Panelboard directories shall be typewritten, and shall include adequate descriptions for proper identification of individual circuits. Do not write in or on panelboards.
 - 3. On Distribution panelboards, provide and install an engraved laminated label for each circuit, indicating circuit's number and load served.
 - 4. Each panelboard shall have an engraved phenolic plate permanently installed on the front of the panel with the panel name, current rating, and voltage rating.
 - 5. Where there is more than one nominal voltage system each panelboard shall have an engraved phenolic plate describing the means of identification used to identify each phase, neutral, and grounding conductors of the system served by the panelboard per NEC.
 - 6. Plates shall be white with black lettering.
- D. Wall Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on the wall plate.
- E. Receptacles: Install a label on the face of the coverplate and tags or wire markers inside the outlet box identifying the panelboard and circuit number from which the outlet is served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of coverplate- black print on clear tape on light colored or stainless steel plates and white print on clear tape on

dark colored plates. Embossed tape labels will not be accepted. Use durable wire markers or tags within outlet boxes.

- G. Disconnect Switches:
 - 1. Install an engraved phenolic nameplate on the front of each switch enclosure identifying the equipment served by the safety switch and source of power (i.e., panel name and circuit number).
 - 2. Plates shall be white with black lettering.
 - 3. The plates shall be permanently installed with stainless steel screws or stainless steel rivets. Plates installed with glue or other adhesives will not be accepted.
 - 4. Where motor rated switches are used as service disconnect switches, labeling shall be as described for receptacles.
- H. Junction boxes: Identify circuits enclosed in concealed junction boxes on the cover with permanent marking pen.
 - 1. For power and lighting circuits indicate panelboard of origin and panelboard circuit number(s).
 - 2. For auxiliary systems circuiting indicate the system and zone served.
- I. Service disconnects:
 - 1. An additional engraved sign shall be permanently attached next to panelboard circuit breakers, on enclosed circuit breaker enclosures, and/or on disconnect switches used as service disconnects to identify each main service disconnect.
 - 2. The sign shall be red with white lettering a minimum of 1/2" high.
 - 3. Where multiple main disconnects are utilized the labels shall identify each as one of a group, i.e., "Service Disconnect 1 of 3", etc. where there are three service disconnects.

3.30. INSTALLATION OF CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM:

- A. Examine areas to receive replacement components as well as new location for head-end. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not begin installation until unacceptable conditions are corrected.
- B. Protect CCTV system from damage during construction.
- C. Install CCTV system in accordance with manufacturer's instructions at locations indicated on the Drawings. Mount equipment plumb, level, square, and secure.
- D. Adjust CCTV system for proper operation in accordance with manufacturer's instructions.
- E. Demonstration: Demonstrate that CCTV system functions properly. Perform demonstration at final system inspectino by qualified representative of manufacturer.
- F. Instruction and Training:
 - 1. Provide instruction and training of Government's personnel as required for operation of system.
 - 2. Provide hands-on demonstration of operation of system components and complete system, including user-level program changes and functions.
 - 3. Instruction and training shall be provided by a qualified representative of manufacturer.

3.31. SECONDARY SURGE ARRESTERS:

- A. Secondary surge arresters shall be installed in strict accordance with the manufacturer's recommendations.
- B. Arrester may be mounted to the side of a surface mounted panelboard or trough. If such a surface is not available, the arrester shall be mounted on a bracket in its own flush mount enclosure located immediately adjacent to the service panel. Insure that all leads are attached per manufacturer's recommendations. Excess lead length shall be cut off prior to making connections.
- 3.32. CONCRETE:
- A. The Electrical Contractor shall be responsible for placing concrete for electrical equipment pads, lighting standard bases, electrical equipment supports, and at other locations as indicated on the electrical drawings and/or specified herein.
- B. This Contractor shall be responsible for size, location, and orientation of the pads, bases, etc. Any required additions or modifications to concrete due to incorrect size, location, or orientation shall be the responsibility of this contractor.
- C. Concrete shall be cured for a period of not less than seven (7) days prior to setting poles, transformers, switchgear, motor control centers, or other pad mounted equipment.
- D. Forms shall be completely removed after concrete has cured and prior to setting equipment.
- E. A smooth wood float finish shall be given to exposed, unformed concrete.
- F. Honeycombed, or otherwise defective areas of concrete shall be repaired by patching with cement mortar.

3.33. EQUIPMENT TOUCHUP AND PAINTING:

- A. Clean damaged and disturbed areas on all painted surfaces of enclosures, cabinets, and equipment, sand smooth, and apply primer, intermediate, and finish coats of paint to suit the degree of damage at each location. Paint shall be the manufacturer's supplied touch up paint or a matching paint. Prep all surfaces to be painted by removing all rust, dirt, oil, and any other material that might inhibit good paint adhesion by mechanical means and/or with solvents.
- B. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
- C. Repair damage to galvanized finishes with two coats of zinc-rich paint recommended by manufacturer.
 - 1. Paint cut ends.
 - 2. Paint all drilled and punched holes.
 - 3. Paint all knicks and scratches.
 - 4. Paint all field cut conduit threads.
- D. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

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SECTION 260715

DATA/TELECOMMUNICATIONS

PART 1 - GENERAL

1.01. RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division-1 Specification, and Division 26 Electrical sections apply to work specified in this section.

1.02. QUALIFICATIONS:

A. The Data/Telecommunications Contractor must be properly licensed as a General Contractor and established as an Data/Telecommunications contractor at the location of the work and shall have had experience in the satisfactory installation of at least three (3) similar type and size jobs.

1.03. CODES, PERMITS AND INSPECTIONS:

- A. Comply with applicable laws of the community, with latest edition of National Electrical Code (NEC), NFC 70, and the International Building Code(IBCC) or the edition adopted by the local authority having jurisdiction, where not in conflict with those laws, and with the service rules of the local utility company.
- B. Obtain and pay for all permits and deposits, and arrange for inspections as required.
- C. After completion of the work, submit certificate of final inspection and approval from the local electrical inspector, certifying that the installation complies with all regulations governing same.

1.04. MATERIALS:

- A. All materials shall be new, and UL approved where a standard has been established.
- B. Manufacturers' names and model numbers shown on the plans and in the specifications are given to indicate the type and general quality of items to be provided. Equal products by other manufacturers will be accepted.
- C. Material substitutions will be considered only when evidence of equality and suitability, satisfactory to the Architect/Engineer has been presented in writing, with samples if requested by the Architect/Engineer.
- D. All proposed substitutions shall be approved in writing at least seven (7) days prior to the bid date.
- E. It shall be understood that the Architect/Engineer has the authority to reject any material or equipment used which is not specified or approved, or showing defects of manufacture or workmanship, before or after such material or equipment is installed.

1.05. WORKMANSHIP:

Execute all work so as to present a neat and workmanlike appearance when completed.

1.06. DESCRIPTION OF WORK:

- A. Furnish all labor and materials required to complete the electrical work indicated on the Technical, "T", drawings or herein specified.
- B. Major work included in this section shall be:
 - 1. Furnish and install a complete system of face plates, jacks, and cables for the telephone system.
 - Furnish and install a complete system of face plates, jacks, Category 6 cables, data/telecommunications equipment racks, Cat 6 patch panels, and fiber optic cables and fiber optic patch panels for the Data System.
 - Furnish and install a system of "J" hooks and/or Bridal rings for supprot of the speaker cables.

DATA/TELECOMMUNICATIONS

- C. Coordinate the layout of Data/TeleCommunications cable tray, conduits, and outlets with the installing Electrical Contractor.
- D. Procure and pay for permits and certifications as required by local and state ordinances and Fire Underwriters certificate of inspection.
- E. Visit the site and determine conditions that affect this contract. Failure to do so will in no way relieve the Contractor of his responsibility under his contract.
- F. Submit to the Architect a certificate of final inspection from local and/or state inspection authorities.

1.07. DRAWINGS AND SPECIFICATIONS:

- A. This Contractor shall examine drawings and Specifications relating to the work of all trades and become fully informed as to the extent and character of work required and its relation to all other work in the project prior to submission of bid and prior to the start of any construction.
- B. Drawings and Specifications shall be considered as complementary each to the other. What is called for by one shall be as binding as if called for by both. Where conflicts occur, secure clarification from the Architect in advance of bidding; otherwise incorporate the more stringent conditions into the bid price.
- C. Omissions from the drawings and specifications or the mis-description of details of work which are evidently necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omissions and details of work; they shall be performed as if fully and correctly set forth and described in the drawings and specifications
- D. The drawings indicate diagrammatically the extent, general character, and the approximate location of the work to be performed. In the interest of clearness, the work is not always shown to scale or exact location. Check all measurements, locations of conduit, fixtures, outlets, and equipment with the detailed architectural, structural, and mechanical drawings, and lay out work so as to fit in with ceiling grids, ductwork, sprinkler piping and heads, and other parts. Take finished dimensions at the job site in preference to using scale dimensions.
- E. Where the work is indicated but with minor details omitted, furnish and install the work complete so as to perform its intended functions.
- F. Where doubt arises as to the meaning of the plans and specifications, obtain the Architect's decision before proceeding with parts affected; otherwise assume liability for damage to other work and for making necessary corrections to work in question.
- G. Except as noted above, make no changes in or deviations from the work as shown or specified except on written order of the Architect.

1.08. EXISTING CONDITIONS:

- A. Before submitting a bid, visit the site and ascertain all existing conditions.
- B. Make such adjustments in work as are required by the actual conditions encountered.
- C. No consideration will be given after bid opening for alleged misunderstandings regarding utility connections, integration of work with existing system, or other existing conditions.

1.09. SUBMITTALS:

- A. Follow procedure outlined in Division 1.
- B. Submittals shall be bound together and shall include a coversheet indicating the following:
 - 1. Project name
 - 2. Trade contractor's name
 - 3. Supplier's name
 - 4. Name and phone number of supplier's contact person
 - 5. A list of each item submitted with manufacturers' names and model numbers.
- C. Within 20 days of award of contract and prior to beginning any work on the project submit six
 (6) copies of manufacturer's drawings/data sheets for the following items to the Engineer for review:

- 1. Switches
 - a. Cisco Switch as called out on drawings
- 2. Data/Telecommunications System
 - a. Cable
 - 1) Cat 6
 - 2) Fiber optic
 - b. Equipment
 - 1) Bridal Rings and/or "J" hooks
 - 2) Equipment Racks
 - 3) Cat 6 patch panels
 - 4) Cat 6 Terminations
 - 5) Cat 6 Jacks, Mountings, and Coverplates
 - 6) Fiber Optic Patch Panels
 - 7) Fiber Optic Cable Terminations
 - c. Installer qualifications
 - d. Makes and Model Numbers of Testing Equipment to be used.
- D. Submit samples upon request.
- E. The Contractor is responsible for verifying all quantities and for verifying and coordinating dimensional data with the available space for items other than the basis of design.
- F. The contractor shall review and approve, or make appropriate notations on each item prior to submittal to the architect. Submittals without contractor's approval will be rejected.

1.10. PROGRESS OF WORK:

A. Schedule work as necessary to cooperate with other trades, Do Not delay other trades. Maintain necessary competent mechanics and supervision to provide an orderly progression of the work.

1.11. CLEANING UP:

A. During the progress of work, keep the Owner's premised in a neat and orderly condition, free from accumulation of debris resulting from this work. At the completion of the work, remove all material, scrap, etc. not a part of this Contract.

1.12. AS-BUILT DRAWINGS, AND OPERATING AND MAINTENANCE INSTRUCTIONS:

A. Prior to the Final Acceptance Inspection the Contractor shall turn over to the Architect one set of reproducible "as built" drawings, including corrected fire alarm system shop drawings, three (3) sets of all equipment catalogs and maintenance data, manufacturers' warranties, and three (3) sets of shop drawings on all equipment.

1.13. INSPECTIONS:

A. The contractor shall have all systems ready for operation and an electrician available to assist in the removal of panel fronts, coverplates, fixture doors, etc., at the final inspection and any other scheduled inspections

1.14. WARRANTY:

- A. Warrant the entire electrical system in proper working order. Replace, without additional charge, all work or material that may develop defects (ordinary wear and tear or damage resulting from improper handling excepted) within a period of one year from date of final to general contractor. Provide the owner with two bound copies of all manufacturers' warranties.
- B. Data and Telecommunications system cabling shall be warranted for a minimum of 15 years.

1.15. DEFINITIONS:

"AWG" - American Wire Gauge

"As required" - Any and all items required to complete the installation of an item so as to perform its intended function.

"Circuiting" - Conductors, raceways, raceway fittings, and associated hardware.

"EMT" - Electrical Metallic Tubing, "thin wall"

- "Install" furnish, install, and make all necessary connections to and/or for the item(s) indicated or specified.
- "NEC" National Electrical Code, ANSI/NFPA 70, latest edition.
- "Necessary" Any and all items required to complete the installation of an item so as to perform its intended function.
- "NEMA"- National Electrical Manufacturers' Association
- "NFPA" National Fire Protection Association
- "PVC Conduit" Rigid Nonmetallic Polyvinyl Chloride conduit
- "RMC Conduit" Rigid galvanized steel conduit
- "UL" Underwriters' Laboratories, Inc.

PART 2 - MATERIALS

2.01. GENERAL:

- A. This section includes all basic materials as required for a complete installation.
- B. All materials shall be new and listed by the Underwriters Laboratories. Material substitutions will be considered only when evidence of equality and suitability, satisfactory to the Architect has been presented in writing, with samples if requested by the Architect.
- C. It shall be understood that the Architect/Engineer has the authority to reject any material or equipment used which is not specified or approved, or showing defects of manufacture or workmanship, before or after such material or equipment is installed.
- D. Contractor shall coordinate with drawings and provide additional equipment as shown on drawings.

2.02. INSTALLER:

- A. Qualifications of Data/Telecommunications Systems Installer:
 - 1. The Data/Telecommunications Systems contractor shall be properly licensed and established in the business of data and telecommunications systems installation.
 - Each Data and Telecommunications System Installer shall have a minimum certification of Level II Installer by BiCSi. Proof of Certification shall be provided prior to beginning installation.
 - Installers shall be certified by the cable manufacturer and the connectivity hardware manufacturer and the entire structured cabling system covered by a manufacture/installer -15 year, minimum, warranty. Proof of Certification and Warranty agreement shall be provided prior to beginning installation.

2.03. DATA AND TELECOMMUNICATIONS CABLE HANGERS:

- A. "D" Rings shall be 3" aluminum or steel "D" Rings equal to Senior Ind. #SI-4754.
- B. Bridle Rings shall be 3" with wood screw heads equal to Senior Industries #SI-0063.
- C. J-hooks shall be 2" or 4" equal to B-Line #BCH32 or #BCH64 with cable retainers.
- D. J-hook Multi-tier supports shall be factory assembled units equal to B-Line BCH series hangers.
- E. All J-Hooks shall be equipped with cable retainers equal to B-Line #BCHR Quik-Latch cable retainers of the proper size.

2.04. DATA AND TELECOMMUNICATIONS OUTLETS:

- A. Data and Telecommunications outlets shall be modular, Category 6 outlets configured for T568B (AT&T) termination. Modules shall be equal to #OR-TJ600.
- B. Modules shall be mounted in brackets that allow use of standard receptacle faceplates. Brackets shall be the same color as the wiring devices and shall be equal to Ortronics #OR-40800019.
- C. The face of modules/jacks shall be flush with the face of the coverplate.

- D. Each outlet coverplate shall be capable of housing a minimum of four (4) data/telecommunications jacks.
- E. Each DataTelecomm outlet shall have a minimum of two (2) RJ45 Category 6 jacks installed or shall have the number of jacks indicated on the plans
- F. All unused jack ports shall be equipped with matching blank filler.
- G. Equal outlets by Systimax, Hubbell, or Pass & Seymour shall be acceptable.

2.05. PATCH PANELS:

- A. Rack Mounted Cat 6 Patch Panel:
 - 24 Port Patch Panel: The patch panels shall be 24 port (eight 6 port), standard density, T568B (AT&T) Category 6, modular panels with 110-style punch down terminations equal to as shown on drawings patch panel. The panels shall be 2 rack units high.
 - 48 Port Patch Panel: The patch panels shall be 48 port (eight 6 port), standard density, T568B (AT&T) Category 6, panel with 110-style punch down terminations equal to as shown on drawings patch panel. The panels shall be 3 rack units high.
 - 3. Equal products by Amp, Hubbell, or Pass & Seymour shall be acceptable.
- B. Horizontal Cable Management Panel:
- C. Horizontal Cable management Panels shall be feed through type, 1.7" high x 3.5" deep, to fit standard 19" wide rack and shall have four (4) 1" x 2" cutouts. The panel shall be equal to Ortronics #OR-60400129. The panel shall be 1 rack unit high.
- D. Equal products by Amp, Hubbell, or Pass & Seymour shall be acceptable.
- E. Rack Mounted Fiber Optic Patch Panel:
 - 1. Fiber Optic Cable Patch Cabinets shall be low profile, 1.75" high, 12 port, 19" rack mounted pre-loaded cabinets with phosphor bronze sleeves for termination of duplex, multimode fiber optic cables.
 - 2. Adapters shall be Type SC with metal sleeves.
 - 3. Face shall be recessed for jumper protection.
 - 4. The Cabinets shall be equal to as shown on drawings
 - 5. Patch panel shall mount in a standard 19" wide rack.
 - 6. Equal products by Belden, Hubbell, or Systimax shall be acceptable.

2.06. DATA/TELECOMMUNICATIONS EQUIPMENT RACKS:

- A. Floor Mounted Equipment Rack:
 - 1. Racks shall be UL 7N69 and 1863 Listed.
 - 2. Racks shall be 84" (45 rack units) tall and shall accept standard 19" wide equipment.
 - 3. Frame shall be black powder coat aluminum.
 - 4. The frames shall be predrilled and tapped with #12-24 threaded EIA hole pattern.
 - 5. Floor mounted equipment racks shall be equal to Hubbell #HPW90RR19.
- B. Vertical Cable Organizers:
 - 1. Vertical Cable Organizers shall be Z-frame, 6" wide complete with cable channels, gates, and hinged covers.
 - 2. Organizers shall come in 38.5" sections with two(2) sections per side.
 - 3. Organizers shall be equal to Hubbell # VC76H.
- C. Equal products by Belden, Hubbell, or Systimax shall be acceptable.

2.07. DATA CABLES:

- A. Cables shall be warranted for a period of 15 years by the manufacturer and installing contractor.
- B. Data/Telecommunications Category 6 Cables:
 - 1. Telephone and Data cables shall be Category 6/Class D, four twisted pair, unshielded, 24 ga. copper cable complying with NFPA 70, NEMA WC 63, ANSI/TIA/EIA/-568-B.1.
 - a. Individual pairs shall be constructed to contain a minimum two twists per foot per each pair.

- b. Overall diameter of four pair cable shall not exceed 0.25 inches. Ultimate breaking strength shall be minimum 90 pounds.
- c. Four pair cable shall withstand a bend radius of one inch minimum at a temperature of minus 20 degrees C maximum without jacket or insulation cracking. Conductors shall be color coded and polarized in accordance with EIA/TIA-568-A.
- d. Cable shall be plenum rated where required.
- 2. Cables shall be manufactured by Berk-Tek, Systimax, and Belden
- C. FiberOptic Cable:
 - 1. Fiber Optic Cable shall be 12 conductor, Single Mode cable.
 - 2. EIA/TIA -568A color coding for fiber optic cable.
 - Aramid yarn strength member, capable of supporting a short-term tensile load of 400 lb. without stretching.
 - 4. Capable of bend radii as small as 20 x outside cable diameter (under installation load) and 10 x outside cable diameter (long term load).
 - 5. Capable of a minimum crush resistance of 850 lb./in.
 - Installed fiber must meet or exceed the following performance specifications. Max. attenuation - 3.75 dB/km @ 850nm, 1.5 dB/km @ 1300nm
 - Min. bandwidth 160 Hz-km @ 850nm, 500 Hz-km @1300nm
 - 7. Fiber Optic Cable shall be manufactured by Siecor, Lucent, or Berk-Tech.
- D. Category 6 Patch Cords:
 - 1. ETL certified to TIA-568-B.
 - 2. Premium Cat 6 4-pair, 24 ga, stranded UTP cable.
 - 3. PVC, Snagless, slip-on boots.
 - 4. Manufactured by Ortronics, Hubbell, or approved equal.

2.08. WARRANTY:

A. The entire Cat 6 and fiber optic premise wiring system shall be warranted in writing by the cable manufacturer and certified contractor for a minimum of 15 years.

PART 3 - EXECUTION

3.01. GENERAL:

A. This section includes the installation of the complete electrical system.

3.02. GROUNDING:

- A. All equipment and cable grounds shall be terminated on the grounding lug on the equipment rack.
- B. All cable trays shall be grounded.

3.03. DATA AND TELECOMMUNICATIONS SYSTEMS:

- A. All Data/Telecommunications Contractor personnel handling cable or equipment on the jobsite shall be minimum of BiSCI Level II installers.
- B. All cables shall be installed by the Data/Telecommunications Contractor under the direct supervision of a BiCSI Level II installers.
- C. All personnel installing cables, and outlets shall be minimum BiSCI Level II certified installer.
- D. Floor mounted racks shall be installed as detailed on the drawings.
- E. Equipment layouts shown for the equipment racks on the plans are intended to indicate the equipment to be supplied and installed by this contractor. Final layout of the equipment in the racks shall be as approved and directed by the St. Clair County Schools Director of Technology.
- F. Each Data/TeleCommunications outlet shall have a Category 6 unshielded 4 twisted pair cable installed from each jack to a patch panel on the Equipment Rack serving the area.

- G. Make all terminations at jacks and patch panel in accordance with industry standards.
- H. Cable installation:
 - Where cables are installed in conduit, the rated cable pulling tension of the cables shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs.
 - 2. Cable shall not be spliced.
 - 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
 - 4. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12" shall be maintained when such placement cannot be avoided.
 - 5. All cables, except the paging system cables, shall be terminated at both ends; no cable shall contain unterminated elements.
 - Data/Telecomm outlet cables(Cat 6) shall be terminated on the jacks and the patch panels.
 - b. Telephone cables(25 and 50 pair) shall be terminated on the patch panels at the remote CBB's and on the 110 punch down block at CBB-A1.
 - Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered.
 - 7. Cable bending radius shall be 1" minimum. Minimum bending radius shall not be exceeded during installation or once installed.
 - Cables shall not come in contact with conduits, ceilings, lighting fixtures, ductwork, or water, sewer, or steam piping.
 - Cat 6 cables shall be installed in the conduits from the outlet boxes to the basket cable trays, and from the cable trays to the Data/Telecommunications backboard in the conduits all installed by the Electrical contractor under Section 16100.
 - 10. Where support of the cables provided by the above systems exceeds 4 feet of span the Data/Telecommunications Contractor shall provide additional support by installing "J" hooks where necessary to provide support at 4 feet maximum spacing.
 - 11. Where cables must be supported by "J" hooks installed by this contractor:
 - a. Cables shall be bundled together with nylon cable ties at 3' o.c. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered.
 - b. Hangars shall be configured as required to attach to the structure, wall mounted, ceiling mounted, suspended from all thread rod, or supported on strut attached to the structure. Anchors attached to sheetrock shall not be acceptable.
 - c. Hangars shall be single or multiple tiered as required for the number of cables being supported.
 - d. At Corridor crossings or other locations where wall mounting is impractical hangers shall be double sided, single tier J-Hooks suspended on all-thread rods supported from the building structure or beam clamps at a maximum of 48" on centers.
 - e. No more than 40 Cat 6 cables shall be installed in 2" J-hooks.
 - f. Cables shall not be installed such that J-hooks are deflected, or such that cables are pulled tight against conduit walls where they exit the conduit.
 - 12. Cat 6 cables shall not be bundled with, installed in j-hooks or cable trays with, or installed in conduit with power circuiting, or bell system circuiting,.
 - Cables routed through finished spaces which do not have suspended ceilings shall be installed in conduit. Routing of any exposed conduit shall be coordinated with the architect.
 - Above inaccessible ceilings, cables shall be installed in EMT conduits. Conduits shall be terminated at each end with insulating bushings. Each end of conduit shall be easily accessible.
 - 15. Maximum number of Cat 6 cables(maximum .225" diameter) allowed to be installed in EMT conduit:
 - ¾″ 5 1″ 8
 - 1-1/2" 20

2"	30
2-1/2"	45
3"	70
3-1/2"	90

16. On backboards cables shall be supported on "D" Rings at not more than 12" on centers. Cables shall be attached to the "D" rings in vertical runs with nylon tie wraps.

3.04. CATEGORY 6 CABLE TESTING:

- A. All category 6 circuits shall be tested using a test set that meets the Class II accuracy requirements of TIA/EIA TSB 67 standard, including the additional tests and test set accuracy requirements of ANSI/TIA/EIA-568-A-5.
- B. Testing shall use the Basic Link Test procedure of TIA/EIA TSB 67, as supplemented by ANSI/TIA/EIA-568-A-5.
- C. All metallic cable pairs shall be tested for proper identification and continuity.
- D. All opens, shorts, crosses, grounds, and reversals shall be corrected. Correct color coding and termination of each pair shall be verified in the communications closet and at the outlet.
- E. Horizontal wiring shall be tested from and including the termination device in the communications closet to and including the modular jack in each room.
- F. Makes and model numbers of testing equipment shall be provided to the Engineer for approval prior to beginning installation.
- G. Each Category 6 cable shall be tested in accordance with ANSI/TIA/EIA TSB-67 for Link Performance Verification.
- H. Phone outlets with RJ11 terminations shall have a Cat 6 connector installed for testing. After testing and certification of the cable the cable shall be terminated on the telephone jack.
- I. Each Pair of conductors in each cable shall be tested for the following:
 - 8) Wire Map
 - 17. Length
 - 18. Attenuation
 - 19. Near End Crosstalk Loss (NEXT): Tested from both ends of cables.
- J. Any cable(s) not meeting the minimum standards of ANSI/TIA/EIA TSB-67 shall be removed and replaced.
- K. Results of the tests for each cable shall be printed out with the name of cable as affixed to the cable and terminals on site.
- L. A bound copy of all test results shall be provided to the Engineer and Owner prior to final inspection. The results shall be bound in protective sleeves in a three ring binder.

3.05. OPTICAL FIBER CABLE:

- A. All optical fiber cable shall be installed in 1" EMT conduit above grade and RMC conduit below grade. After installation, conduits shall be permanently labeled as containing fiber optic cable.
- B. Innerduct may be installed from the horizontal runs of EMT down to the Data Racks.
- C. Optical fiber cables shall not be spliced. Each cable shall be continuous from Patch Cabinet to Patch Cabinet
- D. All Optical Fiber Cable shall be pulled with hand power only. Pulling tension shall not exceed the cable manufacturer's rating. Torsion shall be avoided by the use of a swivel at the cable end. While under tension, a minimum bend radius of 20 times the outside cable diameter will be maintained through the use of pulleys and sheaves where required. After pulling, no bend may have a radius, at rest, of less than 10 times the outside cable diameter.
- E. Provide cable lubricant compatible with the cable sheathing material when pulling cable. Attach pulling fixtures to the cable strength members. When indirect attachments are used, match the grip diameter and length to the cable diameter and characteristics. When indirect attachment is used on cables having only central strength members, reduce pulling forces to ensure that fibers are not damaged from forces being transmitted to the strength member.

During pulling of the cable, continuously monitor pull line tension and shall not exceed maximum tension given by the cable manufacturer. Mechanical stress placed upon the cable during installation shall be such that cable is not twisted or stretched. Provide cable feeder guide between cable reel and face of duct or conduit to protect and guide cable into the duct or conduit as it played off the reel. As the cable is played off the reel, carefully inspect for jacket defects. Take precautions during the installation to prevent the cable from being kinked or crushed and to insure that minimum bend radius is not exceeded at any time. When practicable, use the center pulling technique to lower pulling tension. Pull cable from center point of cable run towards the end termination points. Method may require cable to be pulled in successive pulls. When cable is pulled out of a manhole or handhole, protect cable from dirt and moisture by laying cable on a ground covering.

- F. Each cable and conduit or inner duct is to be permanently labeled at each end with a unique cable number. In addition, labels shall be affixed to the cable and conduit/inner duct at every transition of a vault, hand hole, riser closet, or major pull box. For example, from Server Room to each building wing should be labeled as "FIBER-1, FIBER-2, FIBER-3 & FIBER-4 or some unique numbering scheme to identify each cable run.
- G. Termination Standards
- H. The terminal ends of all fiber cable strands shall be field connectorized. The connectors shall be mounted on backboards and installed in enclosures called Fiber Integration Centers (FIC). Terminate both ends of all fibers within a fiber cable with SC style connectors.
- I. Fiber Organizers: Fiber cables are to be terminated in fiber optic cable patch panels installed where indicated on the drawings.
 - Each enclosure shall be labeled with a machine made label with permanent black ink on a white background. Labels shall be in the format to identify each cable run as well as the fiber pairs of each run. Labeled shall be on the faceplate with the identifiers of the cables it contains.
 - 2. Each fiber optic strand shall be labeled with a unique identifier at the SC coupler in the FIC. Connectors shall be labeled on the identifying sheets on the front of the FIC.
 - Connectors and Splices: Fibers ends are to be terminated in SC-type connectors with composite ferrules. They must be of the "polish and adhesive" type. All runs are to be solid length point to point with no breaks to the termination points.
 - At each end of the cable, sufficient slack (10-15 ') shall be left to facilitate reasonable future relocation of the FIC. Slack shall be mounted on walls or ladder racks according to direction.

3.06. OPTIAL FIBER CABLE TESTING:

- A. Before Installation each individual fiber in each cable shall be tested with an adjustable OTDR for length and transmission anomalies while on the reel before installation.
 - 1. Perform test on 100 percent of the fibers of each circuit and repeat from the opposite end of each circuit. Field tests shall include as a minimum:
 - a. Optical time domain reflectometer (OTDR) test at 850 nanometers, of the FO cable on the reel prior to installation. Calibrate OTDR to show anomalies of 0.2 dB as a minimum. Submit photographs traces to the Engineer.
 - b. Scale of the OTDR trace shall be such that the entire circuit appears over a minimum of 80 percent of the X-axis.
 - After installation, repeat the OTDR test in item 1. above. Replace cables that failed the test. Test new segment of cable to demonstrate acceptability. Submit photographs traces for each circuit to the Contracting Officer.
- B. After Installation
 - 1. High-resolution optical time domain reflectometer (OTDR) tests shall be performed from one end of each fiber.
 - 2. All single mode and multi mode fiber strands shall be tested end-to-end for bi-directional attenuation at 850 nm and 1300 nm.
 - 3. Tests should be conducted in compliance with EIA/TIA-526-14, Method B, according to the manufacturer's instructions for the test set being utilized.

- 4. Tests must ensure that the measured link loss for each strand does not exceed the "worst case" allowable loss defined as the sum of the connector loss, (based on the number of mated connector pairs at the EIA/TIA-568 maximum allowable loss of 1.0 dB per mated pair), and the optical loss (based on the EIA/TIA-568 maximum allowable loss of 3.75 dB at 850 nm and 1.5 dB at 1300 nm).
- 5. Before termination, each fiber shall be tested with an adjustable ODTR for length, transmission anomalies, and end-to-end attenuation. Results are to be recorded and supplied to Engineer in the form of hard-copy printouts or photographs of screen traces.
- 6. After termination connectors shall be visually inspected for scratches, pits or chips and shall be reterminated if any of these conditions exist.
- 7. Each terminated fiber is to be tested for end-to-end loss. As above, results are to be recorded and supplied to the Engineer.
- 8. The maximum allowable attenuation for any splice or termination is 0.5 dB.
- C. Any fiber optic cable not meeting the minimum standards shall be removed and replaced or if it is determined that splices or terminations are at fault the splice or termination at fault shall be replaced and the cable retested.

3.07. LABELING:

- A. Cat 6 Cables:
 - 1. Each jack, Cat 6 cable, and fiber optic cable shall be labeled with an alpha/numeric identifier with a corresponding identifier on the punch down block and/or patch panel.
 - 2. The number shall include the alpha/numeric patch panel name and the alpha/numeric patch panel port name where the cable is terminated.
 - 3. Labels shall be installed at each end of Cat 6 cables where terminated.
 - 4. A floor plan of the facility shall be provided showing outlet locations and cable identifiers for each cable and the location of all patchpanels with the corresponding identifiers.
- B. Fiber Optic Cables:
 - 1. Each Fiber Optic cable shall be labeled with an alpha/numeric identifier.
 - Each fiber in a fiber optic cable shall be labeled with an alpha/numeric identifier corresponding to the cable number, the patch panel number, and fiber identifier(typically A through F for a six fiber cable).
 - 3. Labels shall be installed at each end of cables where terminated and on each fiber of each cable at the point of termination.
 - A floor plan of the facility shall be provided showing all patch panels with the corresponding identifiers, and cable identifiers for each cable at each patch panel.

3.08. PATCH CORDS:

- A. Patch cords shall be factory assembled and tested. Shop or field assembled cords shall not be acceptable.
- B. Deliver the following patch cords to the Alabama National Guard Director of Technology:
 - 1. 50 Category 6 3' to 4' patch cords.
 - 2. 100 Category 6 1' to 2' patch cords.
 - 3. 20 Category 6 14' to 16' patch cords.
 - 4. 10 fiber optic, 3 meter, single mode, SC to SC

END OF SECTION

Section 26 08 50 FIRE ALARM AND MASS NOTIFICATION SYSTEM

1. Part 1 -General

1.1. Related documents

A. Drawings and general provisions of the contract apply to this section.

1.2. Summary

1.2.1. Fire and MN

- A. Provide all permits, labor, equipment, materials and services to furnish and install a fully tested functional, UL Listed, code compliant, intelligent addressable networked fire alarm, mass notification and active smoke control system including but not limited to all initiation and notification appliances, all raceways and wiring, connection to a central monitoring station.
- B. The fire alarm system supplied under this specification shall utilize modular low voltage design with direct wired, node to node, peer-to-peer network communications. The system shall utilize independently addressed, fire detection devices, input/output control modules, audio amplifiers, telephone communications and notification appliances as described in this specification. Network panels shall contain the required user interfaces for all functions.
- C. The mass notification system supplied under this specification shall consist of a new Central Control Station (CCS) that shall provide the command and control for all buildings. The CCS shall also provide annunciation for all mass notification and fire alarm events as required by UL 864, UL 2572 and this specification.
- D. The system shall be designed for interior building audibility of 15 dBA-fast over ambient condition and intelligibility. Intelligibility shall be designed to ensure Common Intelligibility Standard (CIS) rating of 0.7 or Sound Transmission Index of 0.5 in all areas designated on the drawings to have intelligible audio.
- E. A dedicated TCP/IP fiber optic network shall be provided to connect the CCS to the ACU/FACP panels located in remote buildings.
- F. All equipment shall be new and the current products of a single manufacturer, actively engaged in the manufacturing and sale of digital fire detection devices for over ten years.
- G. Also included are system wiring, fiber optic cable, raceways, pull boxes, terminal cabinets, mounting boxes, and any accessories and miscellaneous items required for a code compliant system.
- H. The final system shall be complete, tested, and ready for operation as described elsewhere in this specification, before owner acceptance.
- Strict conformance to this specification is required to ensure that the installed and programmed system will function as designed, is compatible with existing systems, and will accommodate the future requirements and operations of the building owner. All specified operational features must be met without exception.

1.2.2. Related Work - Fire and MN

- A. The contractor shall coordinate work in this section with all related trades. Work and/or equipment provided in other sections and related to the fire alarm/mass notification system shall include, but not be limited to:
 - Sprinkler waterflow and supervisory switches shall be furnished and installed by the fire
 protection contractor, but wired and connected by the electrical contractor. Modification of
 existing sprinkler devices to accommodate monitoring by the new fire alarm system shall be
 the responsibility of the fire alarm system installing contractor.
 - Duct smoke detectors shall be furnished, wired and connected by the electrical contractor. The HVAC contractor shall furnish necessary duct opening to install the duct smoke detectors.
 - 3. Dry pipe/deluge sprinkler system release valve control circuits and supervision contacts shall be provided by the dry pipe/deluge sprinkler system control equipment.
 - 4. Kitchen hood extinguishing systems status monitoring.
 - 5. Fire pumps (manual, automatic and special service) status monitoring.
 - a. Pump failure (fail to start) indication
 - b. Pump running indication
 - c. Phase reversal indication
 - 6. Emergency generator status monitoring
 - a. Running indication
 - b. Fail to start indication
 - 7. Existing IP network interface
 - a. Coordinate with the owner's IT department for interconnection between the owner's existing TCP/IP network and the TCP/IP network equipment supplied under this contract.

1.3. References

1.3.1. Codes-General

- A. All work and materials shall conform to all applicable federal, state and local codes and regulations governing the installation. If there is a conflict between the referenced standards, federal, state or local codes, and this specification, it is the bidder's responsibility to immediately bring the conflict to the attention of the engineer for resolution. National standards shall prevail unless local codes are more stringent.
 - B. The bidder shall not attempt to resolve conflicts directly with the local authorities unless specifically authorized by the engineer.

1.3.2. Fire and MNS Codes

A. The equipment and installation shall comply with the provisions of the following codes and standards unless the authority having jurisdiction has adopted an earlier version:

National Fire Protection Association (NFPA)

Underwriter's Laboratories, Inc

Factory Mutual (FM) approval

State of Alabama Fire Marshal Requirements

International Code Council International Building Code International Fire Code International Mechanical Code

Federal Codes and Regulations Americans with Disabilities Act (ADA)

Electrical Industries Association

EIA-232-D: Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange EIA-485: Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems

1.3.3. Definitions and Abbreviations

ACU: Autonomous Control Unit.

ADA: Americans with Disabilities Act.

AFF: Above Finished Floor.

AHJ: Authority Having Jurisdiction.

Approved: Unless otherwise stated, materials, equipment or submittals approved by the Authority or AHJ.

Circuit: Wire path from a group of devices or appliances to a control panel or transponder.

CCS: Central Control Station.

CPU: The central computer of a multiplex fire alarm or voice command control system.

ECS: Emergency Communication System.

FACP: Fire Alarm Control Panel.

FCC: Fire Command Center.

FM: FM Global (Factory Mutual)

FSCP: Firefighter's Smoke Control Panel.

HPSA: High Power Speaker Array.

HVAC: Heating Ventilating and Air Conditioning.

IDC: Initiating Device Circuit.

LCD: Liquid Crystal Display.

LED: Light Emitting Diode.

LOC: Local Operating Console.

MN: Mass Notification.

MNEC: Mass Notification Emergency Communications.

NAC: Notification Appliance Circuit.

NFPA: National Fire Protection Association.

NICET: National Institute for Certification in Engineering Technologies

NRTL: Nationally Recognized Testing Laboratory

PTR: Printer.

RCP: Remote Control Panel

SLC: Signaling Line Circuit.

Style 1: As defined by NFPA 72, Class B.

Style 4: As defined by NFPA 72, Class B.

Style 6: As defined by NFPA 72, Class A.

Style 7: As defined by NFPA 72, Class A.

Style B: As defined in NFPA 72, Class B.

Style D: As defined in NFPA 72, Class A.

Style Y: As defined in NFPA 72, Class B.

UL or ULI: Underwriters Laboratories, Inc.

UL Listed: Materials or equipment listed and included in the most recent edition of the UL Fire Protection Equipment Directory.

Zone: Combination of one or more circuits or devices in a defined building area, i.e. 3 speaker circuits on a floor combined to form a single zone.

1.4. System Description

1.4.1. General Fire and MN

- A. The system supplied under this specification shall be a new UL Listed modular fire alarm & mass notification network that uses independently addressed fire detection devices, input/output control modules, amplifiers and speakers.
- B. The fire network shall utilize token ring, peer-to-peer communications. The network shall consist of one main and multiple remote Autonomous Control Unit/Fire Alarm Control Panels (ACU/FACP). To enhance survivability, each ACU/FACP shall be an equal, active functional member of the network, capable of making all local decisions and initiating network tasks for other panels. In the event of an ACU/FACP failure or communications failure between units, ACU/FACPs shall be capable of forming sub-networks and remain operational between communicating units. Master/slave system configurations shall not be considered as equal.
- C. The system shall be fully field programmable such that virtually any combination of system output functions may be correlated to any type of input event(s). Inputs may be combined using Boolean logic, be time dependent or under manual control, as defined by required system operation. All software operations are to be stored in a non-volatile programmable memory within the fire alarm control panels. There shall be no limit, other than maximum system capacity, as to the number of addressable devices which may be in alarm simultaneously.
- D. Addressable smoke detector sensitivity settings for both pre-alarm and alarm activation shall be automatically individually configurable for both daytime and nighttime operation. Addressable smoke detectors shall be UL listed for automatic sensitivity testing.
- E. Ease of maintenance shall be facilitated by the use of panel based and PC based system diagnostics.
 - 1. The system shall automatically test smoke detector sensitivity, eliminating the need for manual sensitivity testing.
 - Ground fault detection and annunciation shall be by individual module address for supervised input and output devices.
 - 3. System test operation shall be configurable by individual addressable devices, and not disable entire circuits.
 - 4. The system shall be capable of generating a graphical map of connected all addressable devices to aide in circuit troubleshooting.
 - Placement supervision of addressable devices shall couple a device's location (not its address) to the programmed system response.
- F. The system shall provide a one-way multi-channel emergency communication sub-system for the distribution of emergency messages to facility occupants.
- G. The mass notification network shall connect the main ACU/FACP or Central Command Station (CCS) to all remote ACU/FACPs. The CCS shall be capable of initiating live and prerecorded audio messages to any combinations of ACU/FACPs connected to the network, as detailed under the Performance Requirements section of this specification. System ACU/FACPs and LOCs shall utilize configurable message routing and selective event messaging to direct event information only to the required system displays and printers as determined by the event type and location.
- H. A dedicated fiber optic TCP/IP network utilizing UL864 listed network components shall be supplied to interconnect the CCS with the ACU/FACPs and LOCs in remote buildings.
- 1. The existing fire alarm (If designated on the plans) shall be removed and discarded and new

control panels, power supplies, audio/visual indicating appliances (wiring may be reused if warranted as new and will work with new system if electrically sound) and related equipment shall be installed as specified.

1.4.2. Fire Alarm Performance

1.4.2.1. General Requirements

- A. Comply with the provisions of NFPA 72 and the operational requirements of this specification.
- B. The system shall identify all off normal conditions and log each condition into the system as an event.
 - 1. The system shall automatically display on the control panel Liquid Crystal Display (LCD) the first (oldest) event of the highest priority by type. The event priority shall be alarm, supervisory, trouble, and monitor.
 - The system shall utilize four event queues, and shall not require event acknowledgment by the system operator. Labeled, color coded indicators shall be provided for each type of event queue: alarm - red, supervisory - yellow, trouble - yellow, monitor - yellow. When an unseen event exists for a given type, the indicator shall be lit.
 - 3. For each event, the display shall include the current time, the total number of events, the type of event, the time the event occurred and up to a 42 character custom user description.
 - 4. The user shall be able to review each event queue by simply selecting scrolling keys (updown) for the event type.
 - 5. New alarm, supervisory, or trouble events shall sound a distinct, silenceable audible signal at the control panel.
 - 6. The LCD shall show the number of active alarm, supervisory, trouble and monitor events
 - 7. The LCD shall show the system time and the number of active and disabled points in the system.
 - 8. Specific input/output devices shall operate in accordance with the alarm, supervisory, trouble, monitor sections that follow and the input/output matrix.
- C. All critical systems, sub-systems and circuits shall be monitored for integrity. System faults shall be annunciated.
- D. Strobes shall be synchronized on each floor.
- E. Batteries shall be sized to support the system for 24 Hrs. of standby operation followed by 15 minutes of alarm operation at the end of the 24 Hour period.
- F. Off premises reporting of the loss of AC mains power to any system component shall be automatically delayed for a period of time acceptable to the AHJ to reduce traffic at the central monitoring station due to wide-area power failures.
- G. The system shall provide configurable service groups to facilitate "one man" testing of the system based on the physical layout of the building. Each service group shall be capable of supporting any combination of system devices, independent of the circuit on which they are installed. Systems that disable entire circuits, circuits serving multiple floors or fire zones for testing shall not be considered as equal. Activated devices on a service group shall be capable of initiating alternative system test responses to facilitate system maintenance and minimizing occupant disturbances while in test mode.
- H. Event processing and display shall be prioritized as follows:
 - 1. Fire alarms
 - 2. Supervisory events
 - 3. Trouble events

4. Monitor events

1.4.2.2. Alarm Operation - MN

A. Signals shall be prioritized and processed in accordance with UL 2572 as indicated below:

Mass Notification (MN) Fire Alarm/Life Safety Other

- B. Only the Central Control Station, a building's Autonomous Control Unit/Fire Alarm Control Panel (ACU/FACP), or a Local Operations Console (LOC) shall be capable of initiating mass notification operation. No automatic operation shall be permitted.
- C. Operation of any Mass Notification Emergency Communication (MNEC) functions by a user at a building ACU/FACP or LOC shall be indicated at the CCS.
- D. Operation of any MNEC functions by a user at the CCS shall be indicated at the ACU/FACP(s) and LOC(s) that the respective building system(s) is in the MNEC mode.
- E. The CCS, ACU/FACP(s) and LOC(s) shall display the following information: Power On indication. The status of all signaling zones. The off-normal status of all control switches. The off-normal status of all circuits and functions monitored for integrity.

F. The system shall observe the following priorities for evacuation and relocation signals: The FACP shall not automatically override mass notification messages.

The mass notification system shall not override signals indicating the predischarge warning of special fire suppression systems.

Live pages shall override previously and subsequently initiated signals to the operator selected areas.

Message sources shall be prioritized as follows:

Live local mass notification and fire evacuation messages.

Live remote mass notification and fire evacuation messages.

Automatic pre-recorded mass notification and fire evacuation messages. Non-emergency messages.

G. A Library of pre-recorded messages shall be available for the operator at the CCS or a building ACU/FACP or LOC.

The Fire Alarm and Mass Notification Recorded messages shall be the following:

- 1. (TONE USED FOR FIRE), "MAY I HAVE YOUR ATTEBTION PLEASE?! AN EMERGENCY HAS BEEN REPORTED IN THE BUILDING. WHILE THIS IS BEING VERIFIED, PLEASE LEAVE THE BUILDING BY THE NEAREST EXIT."
- 2. (CHIME) "TORNADO IN THE AREA. SEEK COVER IMMEDIATELY."
- (CHIME) "THERE IS AN INTRUDER ON POST. STAY INSIDE AND SECURE ALL DOORS."
- 4. (CHIME) "BOMB THREAT ISSUED FOR THIS FACILITY. REMAIN CALM. EXIT THE BUILDING. AVOID THE MAIN ENTRANCE."
- (CHIME) "THERE IS AN ACTIVE SHOOTER ON POST. STAY INSIDE. CLOSE DOORS AND WINDOWS."
- 6. (CHIME) "POSSIBLE CONTAMINATION IN THE VACINITY. STAY INSIDE. CLOSE DOORS AND WINDOWS."
- 7. (CHIME) "ALL CLEAR. RESUME NORMAL ACTIVITIES."
- 8. (CHIME) "THIS IS A TEST OF THE NOTIFICATION SYSTEM. CONTINUE

NORMAL ACTIVITIES. THIS IS ONLY A TEST."

Message Notes:

- 1. Contractor shall furnish and have installed a message kit for fire alarm and MNS messages indicated above.
- 2. Messages 1 through 6 shall be in MALE voice and 7 and 8 shall be FEMALE voice.
- 3. Message 1 shall have fire alarm pre-tone and after-tone.
- 4. Messages 2 through 8 shall have chimes for pre-tone and after-tones.

The CCS shall be capable of transmitting messages to any combination of destination buildings.

The ACU/FACP or LOC shall be capable of transmitting messages only within its respective building.

H. The system shall be capable of live voice page from the CCS, a ACU/FACP, or a LOC The CCS shall be capable of live paging to any combination of destination buildings. The ACU/FACP or LOC shall be capable of live paging only within its respective building.

When any mass notification audio circuits are active, synchronized ALERT strobes shall activate in the same areas.

Upon the alarm activation of any area smoke detector, heat detector, manual pull station, sprinkler waterflow , the following functions shall automatically occur:

The system shall remain in the alarm mode until all initiating devices are reset and the fire alarm panel is manually reset and restored to normal.

The internal audible device shall sound at the control panel or command center.

The LCD Display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location and time/date.

All system activity/events shall be logged into system history.

Any remote, local annunciator or LOC LCD/LED's associated with the alarm zone shall be illuminated.

The following audio messages and actions shall occur simultaneously:

An evacuation message shall be sounded. It is the intent of this message to advise occupants hearing this message that they are near danger and should leave the building via the stairs (nearest exit) immediately.

Activate visual strobes. The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the "Alarm Silence" is pressed. An alert message shall be sounded on the remainder of building. It is the intent of this message to advise occupants to prepare for evacuation if necessary.

The notification appliance dedicated to sprinkler system water flow alarm shall not be silenced while the sprinkler system is flowing at a rate of flow equal to a single head.

Transmit signal to the building automation system. Transmit signal to the central monitoring station with point identification. Activate emergency shutoffs for gas and fuel supplies. All automatic events programmed to the alarm point shall be executed and the associated outputs activated. All self-closing fire/smoke doors held open shall be released.

1.4.2.3. Supervisory Operation

A. Upon supervisory activation of any sprinkler valve supervisory switch, waterflow duct smoke

detector, fire pump off-normal, clean agent fire suppression system trouble, the following functions shall automatically occur:

The internal supervisory event audible device shall sound at the control panel. The LCD display shall indicate all applicable information associated with the supervisory

condition including; zone, device type, device location and time/date.

All system activity/events shall be logged to system history.

Any remote, local annunciator or LOC LCD/LED's associated with the supervisory zone shall be illuminated.

Transmit signal to the central monitoring station with point identification.

1.4.2.4. Trouble Operation

A. Upon activation of a **trouble condition** or signal from any device or internal system integrity monitoring function on the system, the following functions shall automatically occur:

The internal panel audible device shall sound at the control panel. The LCD keypad display shall indicate all applicable information associated with the trouble condition including; zone, device type, device location and time/date.

Trouble conditions that have been restored to normal shall be automatically removed from the trouble display queue and not require operator intervention. This feature shall be software selectable and shall not prevent the logging of trouble events to the historical file.

All system activity/events shall be logged to system history.

Any remote, local annunciator or LOC LCD/LED's associated with the trouble zone shall be illuminated.

Transmit a trouble signal to the central monitoring station with point identification.

1.4.2.5. Monitor Operation

A. Upon activation of any device connected to a monitor circuit, the following functions shall automatically occur:

> The internal panel audible device shall sound at the control panel. The LCD display shall indicate all applicable information associated with the status condition including; zone, device type, device location and time/date. All system activity/events shall be logged to system history. Any remote or local annunciator LCD/LED's associated with the monitor circuit shall be illuminated.

1.4.2.6. Fire Suppression System Interface

- A. Smoke detection within the hazard area shall be provided by a grid of multi-sensor smoke detectors installed on 20 foot centers. Activation of the first detector in the grid shall activate the "first detector" functions described below and condition the adjacent detectors in the grid to begin the release sequence, if activated. Activation of any adjacent detector shall start the "confirmation sequence" below.
- B. Provide an automatic extinguishing agent release interface modules at the locations shown on the drawings. The releasing interface shall be suitable for controlling the release of extinguishing agents such as FM-200[®], Inergen[®], CO2, or Halon[®], as well as sprinkler pre-action or deluge systems furnished by others.

C. Each interface shall provide supervised connections for: two agent release solenoid valves, two supervised pre-release notification circuits, a supervised manual release circuit, and a supervised abort switch circuit.

Upon operation of the "first detector" associated with the protected area the system shall:

- 1. Activate fire alarm system
- 2. Display activated initiating device on graphic annunciator.
- 3. Activate visual pre-discharge notification appliances in protected area
- 4. Pulse the audible discharge notification appliances in the protected area
- 5. Release door holders and fire/smoke dampers
- 6. Shut down HVAC system supplying protected area
- 7. Shut down equipment as described on plans.

Upon confirmation of the alarm by a "second detector," the system shall:

- 1. Display second activated initiating device on graphic annunciator
- 2. Start the automatic discharge delay timer (selectable from 0 to 60 seconds in 10 sec. increments)
- 3. Cause the audible discharge notification appliances in the protected area audible to sound continuously 10 seconds before agent release.
- 4. Activate the agent release solenoids at the expiration of the automatic discharge delay timer.

Upon activation of the manual agent release station the system shall:

- 1. Activate fire alarm system
- 2. Display activated initiating device on graphic annunciator.
- 3. Activate visual pre-discharge notification appliances in protected area
- 4. Pulse the audible discharge notification appliances in the protected area
- 5. Release door holders and fire/smoke dampers
- 6. Shut down HVAC system supplying protected area
- 7. Shut down specified equipment in protected area
- 8. Start the manual discharge delay timer (selectable from 0 to 30 seconds in 10 sec. increments)
- 9. Cause the audible discharge notification appliances in the protected area audible to sound continuously 10 seconds before agent release.
- 10. Activate the agent release solenoids at the expiration of the automatic discharge delay timer.
- D. System Abort

If the abort switch is activated before the automatic discharge delay expires, the system will prevent agent release, however the automatic release delay timer will continue to run while the abort switch is active. When the abort switch is restored, agent release will occur upon expiration of the automatic delay timer or the abort delay timer (selectable for 0 or 10 seconds), whichever occurs last.

1.5. Submittals

1.5.1. Submittal General

- A. The contractor shall not purchase any equipment for the specified system until the owner has approved the project submittals in their entirety and has returned them to the contractor.
- B. Approved submittals allow the contractor to proceed with the installation and shall not be construed to mean that the contractor has satisfied the requirements of these specifications.

- C. Each submittal shall include a detailed list of variations that the submittal may have from the requirements of the contract documents.
- D. The contractor shall provide specific notation on each shop drawing, sample, data sheet, installation manual, etc. submitted for review and approval, of each variation.
- E. Any conflicts in the contract documents and/or with Authority Having Jurisdiction (AHJ) requirements shall be submitted to the owner in writing 7 days prior to bid.

F. Provide current Certified Fire Alarm Contractor Permit, issued by the State of Alabama with submittal package.

1.5.2. Submittal Books

- A. Submit for approval no less than three (3) copies of a submittal book to the consulting engineer for review and comment.
- B. Submittal books shall meet the following requirements:
 - 1. Shall be a 3-ring binder with a cover that shows the project address, system type, and contractor.
 - 2. Shall use labeled dividers for major sections.
 - 3. Shall include:
 - a. Cover sheet
 - b. Table of contents
 - i.Provide a list of all types of equipment and components provided. This shall be incorporated as part of a table of contents, which will also indicate the manufacturer's part number, the description of the part, and the part number of the manufacturer's product datasheet on which the information can be found.
 - c. Product data sheets, as detailed elsewhere in this specification
 - d. Provide description of operation of the system (sequence of operation), similar to that provided in Part 2 of this section of the specifications. The description shall be specific to this project, and shall provide individual sequences for every type of alarm, supervisory, or trouble condition, which may occur as part of normal or off-normal system use.
 - e. B-size (black line) reduced shop drawings, as detailed elsewhere in this specification.
 - f. System calculations, as detailed elsewhere in this specification.
 - g. Installation instructions.
 - h. Provide samples of various items when requested.
 - i. Copies of all licenses, documents and certifications, as detailed elsewhere in this specification.

Additional copies may be required at no additional cost to the project.

1.5.3. Product Data

- A. System components proposed in this specification shall be UL listed to operate together as a system. The supplier shall provide evidence, with his submittal, of listings of all proposed equipment and combinations of equipment.
- B. For each product submitted provide the following information:
- 1. Manufacturer's catalog data, to include material description, agency approvals, operating characteristics, electrical characteristics, dimensions, mounting requirements and accessories.

Product data sheets for system components shall be highlighted to indicate the specific

products, features, or functions required to meet this specification.

Alternate or as-equal products submitted under this contract shall provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.

2. Manufacturer's product installation sheets: A copy of the documentation that is required to be shipped with all listed products by UL.

1.5.4. Design Calculations

Battery Capacity

A. Provide battery capacity calculations for each power supply that uses batteries for secondary power. Identify all loads. Identify any loads shed during alarm operation. Use the manufacturer's recommended methods and/or forms.

24 VDC Notification Appliance Circuits

A. For each 24VDC NAC, provide worst case voltage drop calculations. The load shall be treated as a lump sum at the end of the circuit. Worst case power supply terminal voltage shall include all applicable internal power supply losses. Using 85% of nominal circuit voltage (20.4VDC) shall not be accepted as lowest terminal voltage without manufacturer's published documentation stating there are no internal losses in the power supply.

Audio (Speaker) Notification Appliance Circuits - Interior

- A. The system shall be designed for interior building audibility level of 15 dBA-fast over ambient condition and intelligibility. Intelligibility shall be designed to maintain Common Intelligibility Standard (CIS) rating of 0.7 or Sound Transmission Index of 0.5 in all areas designated on the drawings to have intelligible audio.
- B. Provide dB loss calculations for all audio (speaker) notification appliance circuits. Circuits shall be designed for no more than 0.5 db loss based on lump-sum load method.
- C. All areas required to meet intelligibility requirements shall be modeled in a recognized computer modeling program such as EASE by Renkus-Hienz. All modeling output data shall be part of the submittal.

Fiber Optic Circuits

A. Provide optical fiber loss (budget) calculations per segment of optical fiber. Fiber loss per segment shall not exceed 80% of equipment manufacturer's permitted loss.

1.5.5. Shop Drawings

- A. Submit for approval three (3) sets of shop drawings to the consulting engineer for review and comment. Drawings shall be either D-size or E-size blue line drawings and of a sufficient resolution to be completely read. Drawing sets shall be bound. Additional copies may be required at no additional cost to the project.
- B. Contained in the title block of each drawing shall be symbol legends with device counts, wire tag legends, circuit schedules for all addressable and notification appliance circuits, the project name/address, and a drawing description which corresponds to that indicated in the drawing index on the coversheet drawing. A section of each drawing title block shall be reserved for revision numbers and notes.
- C. Shop drawings shall meet the following requirements:

- 1. Shop drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by the manufacturer of the submitted equipment in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III or IV minimum or Alabama registered Professional Engineer.
- 2. Coversheet with project name, address and drawing index.
- 3. General notes drawing with peripheral device backbox size information, part numbers, device mounting height information, and the names, addresses, point of contact, and telephone numbers of all contract project team members.
- 4. Provide device floor plans for all areas served by the fire alarm system. Utilize the CAD Files provided by the consulting Electrical Engineer in the preparation of the floor plans. Floor plans shall indicate accurate locations for all control and peripheral devices. Drawings shall be NO LESS THAN 1/8-INCH SCALE. If individual floors need to be segmented to accommodate the 1/8" scale requirements, KEY PLANS and BREAK-LINES shall be provided on the plans in an orderly and professional manner. CAD plans will be available from the Electrical Engineer of Record for a fee of \$50.00 per page.
 - o All addressable devices shall be shown. Coordinate the device address with the same device shown on the riser diagram.
 - o Identify all notification appliances with a circuit and item number. Coordinate the circuit and item number with the same device shown on the riser diagram.
 - o Show all raceways, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used.
 - Areas required to meet intelligibility requirements shall be clearly identified. Wide area
 mass notification system plot drawings shall identify all project areas that must meet
 intelligibility requirements as well as environmentally sensitive areas on or off of the
 project site where system output shall be minimized.
- 5. Device riser diagram, which individually depict all control panels, annunciators, addressable devices, and notification appliances. Shall include a specific, proposed device description above each addressable device. Shall include a specific, discrete device address that corresponds to addresses shown on the floor plans. Drawings shall provide wire specifications, and wire identification for all conductors depicted on the riser diagram. All circuits shall have identifiers that shall correspond with those required on the control panel and floor plan drawings. End-of-line resistors (and values) shall be depicted.
- 6. Control panel drawing(s) shall show internal component placement and all internal and field terminations. Provide details indicating where conduit connections shall be made to avoid conflicts with internally mounted batteries. For each additional fire alarm panel, a separate drawing which clearly indicated the panel designation, service and location of the control enclosure.
- 7. Provide typical **device wiring diagrams** that show all system components, and the respective field wiring. Wire type, gauge, and jacket shall be indicated. When an addressable module is used in multiple configurations for monitoring or controlling equipment, provide a drawing for each application. End-of-line resistors (and values) shall be shown.
- Provide a fire alarm system function matrix that illustrates alarm input/out events in association with initiation devices. Matrix summary shall include system supervisory and trouble output functions.
- 9. System Calculations as detailed elsewhere in this specification.

1.5.6. Closeout

- A. Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance.
- B. Project specific operating and maintenance manuals covering the system as installed. The manuals shall contain a description of the system architecture, inputs, notification signaling, auxiliary functions, annunciation, sequence of operations, expansion capability, application considerations and limitations. A generic instruction and operation manual shall not be acceptable.
- C. Technical literature (manufacturer's data sheets and installation manuals/instructions) for all parts of the system, including control panels, smoke detectors, batteries, manual stations, alarm notification appliances, power supplies, and remote alarm transmission means.

Software and Firmware Operational Documentation:

A. THE END-USER SHALL RETAIN COMPLETE RIGHTS AND OWNERSHIP TO ALL SITE-SPECIFIC SOFTWARE RUNNING IN THE SYSTEM. The fire alarm equipment supplier shall provide hard and soft copies of the software database to the end-user at the end of the warranty period. The database provided shall be useable by any authorized and certified distributor of the product line, and shall include all applicable passwords necessary for total and unrestricted use and modification of the database.

Drawings

- A. Provide "As Built" drawings of record of all the shop drawings used in the installation of the system.
- B. Refer to the Submittals Shop Drawings section of this specification for drawing requirements.

Record of Completion

- A. System supplier and contractor shall provide a certified test report to verify that the system and all components functioned properly and as intended.
- B. A filled out Record of Completion similar to NFPA 72, 2007 edition figure 4.5.2.1 shall be provided.

Warranty

 Provide copies of the warranty documentation as detailed in the Warranty section of this specification.

Service Organization

A. Provide the name, address and telephone of the authorized factory representative.

Training

A. Conduct the required training as detailed in the Startup and Commissioning - Training section of this specification.

1.6. Quality Assurance

1.6.1. Qualifications of Supplier

- A. The system supplier shall have a minimum of 5 years of experience in distribution and service of the proposed equipment brand.
- B. The supplier shall have successfully designed and installed similar system fire detection, evacuation voice and visual signaling control components on a previous project of comparable scope, size and complexity.
- C. The supplier shall have in-house engineering and project management capability consistent with the requirements of this project. The project shall be supervised by personnel certified by NICET as fire alarm Level III or IV technicians.
 - C. The supplier shall employ qualified and manufacturer certified system designers to perform the detailed engineering design, system calculations, for all the system equipment and programming.
 - D. The supplier shall produce all panel and equipment drawings, submittals, and operating manuals, as detailed elsewhere in this specification.
 - E. The supplier shall be responsible for providing qualified on site representative(s) for coordination of system installation, and final system testing and commissioning in accordance with these specifications.

1.6.2. Qualifications of Installer

- A. Before commencing work, submit evidence showing that the equipment installer has successfully installed systems of the similar scope, type and design as specified.
- B. The contractor/installer shall submit copies of all required Licenses and Bonds as required in the State having jurisdiction.
- C. The contractor/installer shall be responsible for retaining qualified and authorized representative(s) of the system manufacturer (The Supplier) specified for detailed system design and documentation, coordination of system installation requirements, and final system testing and commissioning in accordance with these specifications.
- D. Contractors unable to comply with the provisions of Qualification of Installers shall present proof of engaging the services of a subcontractor qualified to furnish the required services.
- E. The fire alarm/MNS system is being installed in a facility located in the State of Alabama. The Fire Alarm Contractor shall be licensed as a Certified Fire Alarm Contractor by the State Fire Marshal's Office in accordance with Alabama Act 2009-657. The Fire Alarm Contractor shall have a Technician with a minimum NICET Level III certification working in a position of responsibility. All Technicians working for the certified contractor shall have a minimum NICET Level II certification. Any fire alarm contractor wishing to bid on the fire alarm/MNS work shall show evidence of certifications at the pre-bid conference.

1.7. Handling

1.7.1. Delivery and Storage

A. Receiving

The Contractor shall be responsible for all receiving, handling, and storage of his materials at the job site.

- B. Overnight storage of materials is limited to the assigned storage area. Materials brought to the work area shall be installed the same day, or returned to the assigned storage area unless previously approved by the Owner.
- C. The Contractor shall remove rubbish and debris resulting from his work on a daily basis. Rubbish

not removed by the Contractor will be removed by the Owner and back-charged to the Contractor.

1.8. Project Conditions

1.8.1. Responsibility

- A. It shall be the contractor's responsibility to inspect the job site and become familiar with the conditions under which the work will be performed.
- B. A pre-bid meeting will be held to familiarize the contractors with the project. Failure to attend the pre-bid meeting may be considered cause for rejection of the contractor's bid. The minutes of this meeting will be distributed to all attendees and shall constitute an addendum to these specifications.
- C. All work may be conducted during normal working hours, 8:00 a.m. to 5:00 p.m., Monday through Friday. Any other work times must be coordinated with the Guard.

1.9. Warranty

1.9.1. Installation Workmanship and Parts

- A. The contractor shall warranty the installation and workmanship for one (1) year and all parts for one (1) year from date of final acceptance. A copy of the manufacturer's warranty shall be provided with closeout documentation and included with the operation and installation manuals. The full cost of maintenance, labor and materials required to correct any defect during the warranty period shall be included in the submittal bid.
 - B. During the warranty period, each year the contractor shall perform detector sensitivity testing and provide a report to the owner. If the system is UL Listed to perform automatic detector sensitivity testing without manual intervention, and if a detector falls outside of sensitivity window the system automatically indicates a devices trouble, then this requirement shall be waived. Documentation from UL shall be provided as proof of automatic sensitivity testing operation.
 - C. The system supplier shall maintain a service organization with adequate spare parts stock within 75 miles of the installation. Provide a telephone response to owner's questions within 4 hours and on-site assistance within 24 hours.
 - D. Permit the owner's fire alarm technicians to perform temporary bypasses and emergency repairs on the system without voiding the warranty.

1.10. Startup and Commissioning

1.10.1. Test and Inspection - Fire and MN

- A. Testing, general
 - In addition to tests required in this Section, the Contractor shall perform all electrical and mechanical tests required by the equipment manufacturer, the Architect and the Authority having jurisdiction.
 - 2. The contractor shall perform all testing in occupied facilities at times of day that present the lowest impact and disruption to business and activities. Coordinate all testing in occupied buildings with the building owner's representative to assure that fire alarm system testing does

not interrupt operations. This may require extensive after hours work to perform such testing.>

- All equipment, instruments, tools and labor required to conduct the system tests shall be provided by the installing contractor. At a minimum, the following equipment shall be made available testing:
 - a. Ladders and scaffolds as required to reach all installed equipment.
 - b. Meters for reading voltage, current and resistance.
 - c. Two-way communication devices
 - d. Simulated smoke, heat-producing devices for heat detectors, extension poles for introducing smoke into detectors, as needed.
 - e. Manufacturer's instruments to measure air flow through duct smoke detectors.
 - f. Decibel meter and intelligibility testing equipment.
 - g. Status and diagnostic software and PC.
- B. All testing shall utilize a written acceptance test plan for testing the system components and operation in accordance with NFPA 72 and this specification. The contractor shall be responsible for the performance of the acceptance test plan, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and system programming.
 - 1. The systems operation matrix created by the equipment supplier shall be used to identify each alarm input and verify all associated output functions.
- C. The system test plan shall include but not be limited to the following:
 - 1. Visually inspect all wiring.
 - 2. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final acceptance test.
 - 3. System wiring shall be tested to demonstrate correct system response for the following conditions:
 - a. Open, shorted and grounded signal line circuits.
 - b. Open, shorted and grounded notification appliance circuits.
 - 4. System indications shall be demonstrated as follows:
 - a. Correct message content for each alarm input at all system displays.
 - b. Correct annunciator light for each alarm input at each graphic display.
 - c. Correct history logging for all system activity.
 - d. Correct sensitivity for all smoke detection devices. The use of system generated sensitivity reports is acceptable in meeting this requirement.
 - e. Correct signals sent to the Central Monitoring Station.

- 5. Notification appliances shall be demonstrated as follows:
 - a. All alarm notification appliances actuate as programmed
 - b. The system shall be tested for interior building audibility of 15 dBA-fast over ambient condition and intelligibility. Intelligibility shall be tested to ensure Common Intelligibility Standard (CIS) rating of 0.7 or Sound Transmission Index of 0.5 in all areas designated on the drawings to have intelligible audio. The mean value of at least 3 readings shall be required to compute the intelligibility score at each test location.
 - c. For 24VDC NACS, measure and record the voltage at the most remote appliance on each notification appliance circuit, while operating.
- 6. System control functions shall be demonstrated as follows:
 - a. In accordance with the system operation matrix.
- 7. System off premises reporting functions shall be demonstrated as follows:
 - a. Correct information received for each alarm and trouble event
- 8. Secondary power supply (battery) capacity capabilities shall be demonstrated as follows:
 - a. System battery voltages and charging currents shall be measured and recorded at the fire alarm control panels.
 - b. System primary power shall be disconnected for 24 hours. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period of 15 minutes.
 - c. System primary power shall be restored for forty-eight (48) hours.
 - d. System battery voltages and charging currents shall again be measured and recorded at the fire alarm control panels.
- 9. Verify the "As Built" record drawings are accurate.

Preliminary Testing

A. Conduct preliminary tests to ensure that all devices and circuits are functioning properly. Tests shall meet the requirements of the written test plan. Correct any deficiencies, omissions or anomalies and retest the affected devices to assure proper function per the specification.

Acceptance Testing

- A final acceptance test shall not be scheduled until the system manuals are provided to and approved by the owner and the following are provided at the job site:

 "As Built" Record drawings of the system as actually installed
 A copy of the system operation matrix.
- 2. The acceptance inspector shall use the system "As Built" record drawings in combination with the system operation matrix and the written acceptance test plan during the testing to verify system operation.
- Should the system not perform to the above criteria it shall not be accepted and the Contractor shall correct all deficiencies and shall re-test the system at Contractor's expense in the presence of the Architect using the same test criteria.

- 4. The building owner's representative shall witness the final tests.
- 5. The central monitoring station and/or fire department shall be notified before final test in accordance with local requirements.
- Operate every installed device to verify proper operation and correct annunciation at control panel.
- 7. Open signaling line circuits and notification appliance circuits in at least 2 locations to verify presence of supervision.

Test Reports

- A. A "Fire Alarm System Record of Completion" per the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in shall be prepared by the Contractor. Submit three (3) copies to the Architect. The report shall include, but not be limited to:
 - A list of all equipment installed and wired.
 - Certification that all equipment is properly installed and functions and conforms to these specifications.

Sensitivity settings for each ionization and photoelectric detector as measured in place with the HVAC system operating.

DDDDDTechnician's name, certificate number and date.

1.10.2. Training

- A. The system supplier shall schedule and present a minimum of eight (8) hours of formal site specific instruction for the building owner, detailing the proper operation and maintenance of the installed system.
- B. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.
- C. The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.
- D. Copies of all training aids, presentations, etc. shall be left with the owner.

1.11 Maintenance

1.11.1. Spare Parts

A. The contractor shall furnish the following extra material that matches the products installed. Spares shall be packaged with protective covering for storage and identified with labels describing contents.

Automatic detection devices - Two (2) percent of the installed quantity of each type, no less than one piece.

Manual fire alarm stations - Two (2) percent of the installed quantity of each type, no less than one piece.

Glass rods or panels for break glass manual fire alarm stations (if used) - <Ten> percent of the installed quantity, but no less than two devices.

Audible and visible devices - One (1) percent of the installed quantity of each type, but no less than two (2) devices.

Keys - A minimum of three (3) sets of keys shall be provided and appropriately identified.

2. Part 2 - Products

2.1. Fire Alarm Panel

2.1.1. General - Fire

Overview

- A. All materials, equipment, accessories, devices and other facilities and appurtenances covered by these specifications or noted on the drawings shall be new, best suited for the intended use and shall conform to applicable and recognized standards for their use, and supplied by a single manufacturer. Should any equipment provided under this specification be supplied by a different manufacturer, that equipment shall be recognized compatible by BOTH manufacturers and listed as such as required by Underwriters' Laboratories.
- B. The fire alarm control panel(s) shall be a multi-processor based networked system designed specifically for fire, one-way and two-way emergency audio communications, smoke control, and guard patrol applications. The control panel shall be listed and approved for the application standard(s) as listed in the References section of this specification.
- C. The control panel shall include all required hardware, software and site specific system programming to provide a complete and operational system. The control panel(s) shall be designed such that interactions between any applications can be configured, and modified using software provided by the manufacturer. The control panel(s) operational priority shall assure that life safety takes precedence among the activities coordinated by the control panel.
- D. The operating controls shall be located in a dead-front steel enclosure behind a locked door with viewing window. All control modules shall be labeled, and all zone locations shall be identified. All panel modules shall be placement supervised for and signal a trouble if damaged or removed.

System Features

- A. Each control panel shall include the following capabilities:
 - 1. Supervision of the system electronics, wiring, detection devices and software
 - 2. Up to 2500 analog/addressable input/output points
 - 3. Network connections with up to 63 other control panels and annunciators.
 - 4. Support multiple dialers (DACTs) and modems
 - 5. Two communication ports
 - 6. An internal audible signal with different patterns to distinguish between alarm, supervisory, trouble and monitor events
 - 7. Support multiple 24 VDC and Audio NACs
 - 8. User configurable switches and LED indicators to support auxiliary functions
 - 9. Log up to 1740 chronological events
 - 10. The ability to download all applications and firmware from the configuration computer at a single location on the fire network
 - 11. A real-time clock for time stamps and timed event control
 - 12. Electronic addressing of intelligent addressable devices
 - 13. Provide an independent hardware watchdog to supervise software and CPU operation
 - 14. "Dry" alarm, trouble and supervisory relay contacts

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> 15. Control panel modules shall plug in to a chassis assembly for ease of maintenance 16. Field wiring shall connect to the panel using removable connectors

User Oriented Features

- A. Each control panel shall include the following user oriented features:
- 1. An LCD user interface control/display that shall annunciate and control system functions.
- 2. Provide discreet system control switches for reset, alarm silence, panel silence, drill switch, previous message switch, next message switch and details.
- 3. A "lamp test" feature shall verify operation of all visual indicators on the panel.
- An authorized user shall have the ability to operate or modify system functions including system time, date, passwords, holiday dates, restart the system and clear control panel event history file.
- 5. An authorized user shall have the ability to disable/enable devices, zones, actions, timers and sequences.
- 6. An authorized user shall have the ability to activate/restore outputs, actions, sequences, and simulate detector smoke levels.
- An authorized user shall have the ability to enter time and date, reconfigure an external port for download programming, initiate programming and change passwords.
- 8. An authorized user shall have the ability to test the functions of the installed system.
- 9. Service groups shall facilitate one-man walk testing. Service/test groups shall be capable of being configured with any combination of addressable devices, independent of SLC wiring. It shall be possible to program alternate device responses when the device's service group is active. Devices not in an active service group shall process all events normally.
- 10. Provide internal system diagnostics and maintenance user interface controls to display/report the power, communication, and general status of specific panel components, detectors, and modules.
- 11. SLC loop controller diagnostics shall identify common alarm, trouble, ground fault, Class A fault, and map faults. Map faults include wire changes, device type changes by location, device additions/deletions and conventional open, short, and ground conditions. Ground faults on the supervised circuit wiring of remote addressable modules shall be identified by device address.
- 12. An authorized user shall have the ability to generate a report history for alarm, supervisory, monitor, trouble, smoke verification, watchdog, and restore activity.
- 13. System reports shall provide detailed description of the status of system parameters for corrective action or for preventative maintenance programs. Reports shall be displayed by the operator interface or capable of being printed on a printer.
- 14. An authorized user shall have the ability to display/report the condition of addressable analog detectors. Reports shall include device address, device type, percent obscuration, and maintenance indication. The maintenance indication shall provide the user with a measure of contamination of a device upon which cleaning decisions can be made.

Programmability

- A. A Windows-based Configuration Utility (CU) shall be used to create the site-specific system programming. The utility shall facilitate programming of any input point to any output point. The utility shall allow customization of fundamental system operations using initiating events to start actions, timers, sequences and logical algorithms.
- Zoning of initiation devices.
- □ Initiation of events by time of day, day of week, day of year.
- □ Initiation of events by matrix groups (X-Y coordinate relationships) for releasing systems.
- Initiation of events using OR, AND, NOT and counting functions.
- Prioritizing system events.
- □ Programmable activation of detector sounder bases by detector, groups of bases, or all bases.
- Directing selected device messages to specific panel annunciators

- Detector sensitivity selection by time of day
- □ Support of 256 Central Monitoring Station accounts and directing selected device messages to any one of ten Central Monitoring Stations.
- B. The configuration utility shall time and date stamp all changes to the site-specific program, and shall facilitate program versioning and shall store all previous program version data. The utility shall provide a compare feature to identify the differences between different versions of the sitespecific program.
- C. The configuration utility shall be capable of generating reports which detail the configurations of all fire alarm panels, addressable devices and their configuration settings including generating electrical maps of the addressable device SLCs.
- D. The configuration utility shall support the use of bar code readers to expedite electronic addressing and custom programming functions.
- E. Please refer to the General, System Description Section for this project's site-specific system operating requirements.
- F. The Fire Alarm Control Panel shall be equal to an EDWARDS EST3 FIRE/MNS Control. Equal products by Silent Knight, Notifier and FCI will be accepted as an equal if specifications are met.

2.1.2. Power Supply

- A. System power supply(s) shall be a high efficiency switched mode design providing multiple supervised power limited 24 VDC output circuits as required by the panel and external loads fed by the panel. Initial power supply loading shall not exceed 80% of power supply capacity in order to allow for future system expansion.
- B. Each system power supply shall be individually supervised. Power supply trouble signals shall identify the specific supply and the nature of the trouble condition.
- C. It shall be possible to parallel system power supplies to increase capacity or to provide redundant operation.
- D. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any system functionality.
- E. All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 48 hours maximum.
- F. All standby batteries shall be continuously monitored by the power supply. The power supply shall be able to perform an automatic load test of batteries and indicate a trouble condition if the batteries fall outside a predetermined range. Power supplies shall incorporate the ability to adjust the charge rate of batteries based on ambient temperatures. The power supply shall automatically disconnect the battery before low voltage damages the battery. Low battery and disconnection of battery power supply conditions shall immediately annunciated as battery trouble and identify the specific power supply(s) affected.
- G. Batteries shall utilize sealed lead acid chemistry. Initial battery capacity shall provide 125% of calculated capacity requirements in order to allow for future system expansion.
- H. All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of NFPA 70 and NFPA 72. The power circuit disconnect means

shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each control panel the disconnect serves.

2.1.3. User Interface

2.1.3.1. Panel LCD and Common Controls

- A. The system shall be designed and equipped to receive, monitor, and annunciate signals from devices and circuits installed throughout the facility.
- B. Each fire alarm control panel (system node) shall be capable of supporting a backlit LCD display. The display on each system node shall be configurable to *display* the status of any and/or all combinations of all alarm, supervisory, trouble, monitor, or service group event messages on the network. Each LCD display on the system shall be capable of being programmed to allow *control* functions of any combination of nodes on the entire network. The system shall support both 168 character and 960 character LCD displays on the same network.
- C. The LCD display shall provide separate alarm, trouble, supervisory, and monitor event queues of to minimize operator confusion. Receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciation device. The integral audible devices shall produce a sound output upon activation of not less than 85 dBA at 10 feet.
- D. The LCD display shall contain the following system status indicators: System Power Indicator System Test Indicator

System CPU Fail Indicator Ground Fault Indicator Disabled Points Indicator System Normal Indicator System Common Alarm Indicator System Common Trouble Indicator System Common Supervisory Indicator System Common Monitor Event Indicator

E. The LCD display shall contain the following system switch/indicators: System Reset Switch with Indicator System Alarm Silence Switch with Indicator System Panel Silence Switch with Indicator Drill Switch with Indicator Alarm Acknowledge Switch with Indicator Trouble Acknowledge Switch with Indicator Supervisory Acknowledge Switch with Indicator Monitor Acknowledge Switch with Indicator

- F. The LCD display shall contain the following system function switches System Event Message Queue Scroll Switch.
 Event Details Switch (provides an additional 2000 character message about the device highlighted by the operator.)
 Command Menu Switch
 10-Digit Keypad with Enter and Backspace switches
- G. 960 Character Backlit Liquid Crystal Text Display
- H. The user interface shall provide a backlit LCD that will allow custom event messages of up to 42

characters. The interface shall provide a minimum of 24 lines by 40 characters and provide the emergency user hands free viewing of the first seven (7) and last highest priority events. The last highest priority event shall always display and update automatically. Events shall be automatically placed in one of four easy to access queues. It shall be possible to view specific alarm, trouble, supervisory and monitor events separately. Having to scroll through a mixed list of event types shall not be considered as equal. The total number of active events by type shall be displayed. Visual indication shall be provided of any event type that has not been acknowledged or viewed. It shall be possible to customize the designation of all user interface LEDs and Switches for local language requirements.

I. Instructional text messages support a maximum of 2,000 characters each.

2.1.3.2. LEDs and Switches

A. A modular series of switches and LED indicators shall be available to customize the fire alarm control panel operation in accordance with this specification. All LED and switch functions shall be software programmable. Switches shall be configurable for momentary, maintained, toggle, or "exclusive or" operation as required by the application. LEDs shall be configurable for slow flash, fast flash or steady operation. LED/Switch modules shall be supervised. LEDs shall be available fire panel module position. All LED/Switch modules shall be supervised. LEDs shall be available in a variety of colors to facilitate identification from a distance. The LED/Switch modules shall provide ample room for custom function text labels under a protective membrane.

2.1.3.3. Audio Annunciation and Control

- A. Provide a master one-way emergency audio control unit as part of the main fire alarm control panel. The emergency audio control shall contain a paging microphone and shall be capable of generating and delivering multi-channel audio messages simultaneously over copper and/or fiber media to remote parts of the facility.
- B. All audio messages and live pages shall originate at the one-way audio control unit. The one-way audio control unit shall store up to 32 minutes of pre-recorded audio messages digitally as WAV files. These messages shall be automatically directed to various areas in a facility under program control. The unit shall have the capacity to store up to 200 individual audio messages and to simultaneously play back seven (7) different messages in addition to live page message.
- C. During non-alarm conditions, the control unit shall continuously distribute a default audio message to all amplifiers, providing total audio path supervision. To enhance system survivability, each remote FACP cabinet containing an amplifier shall play the default audio message in the event of a fire AND a control network system failure.
- D. The system shall automatically deliver a preannounce tone of 1000 Hz for three seconds when the emergency operator presses the microphone PTT key. A 'ready to page' LED shall flash during the preannounce phase, and turn steady when the system is ready for the user's page delivery. The system shall include a page deactivation timer which activates for 3 seconds when the emergency user release the microphone talk key. Should the user subsequently press the microphone key during the deactivation period a page can be delivered immediately. Should the timer complete its cycle the system shall automatically restore emergency signaling and any subsequent paging will be preceded by the pre-announce tone. A VU display shall indicate voice level to the emergency operator.
- E. The one-way audio control unit shall be capable of supporting up to 64 remote microphone inputs and a line level audio input.
- F. The fire alarm control panels shall support remote cabinets with zoned amplifiers to receive, amplify and distribute messages through speakers over supervised circuits.

2.1.3.4. Remote Microphone

- A. Remote microphones shall be included in the LOCs as indicated on the drawings.
- B. The remote microphone shall facilitate live page announcements over the ACU/FACP system from locations distant from the ACU/FACP. It shall be possible to connect up to 63 remote microphones to an ACU/FACP.
- C. The remote microphone shall feature a Push-to-Talk switch; local and remote page active LEDs, and a trouble LED.
- D. The remote microphone shall operate on filtered-regulated 24 VDC power derived from the panel power supply. Power shall be supplied directly from the ACU/FACP or listed auxiliary power supply, ensuring a reliable and monitored power source.

2.1.3.5. Reports

- A. The system shall provide the operator with system reports that give detailed description of the status of system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the main LCD, and shall be capable of being printed on any system printer.
- B. The system shall provide a report that gives a sensitivity listing of all detectors that have less than 80% environmental compensation remaining. The system shall provide a report that provides a sensitivity (% Obscuration per foot) listing of any particular detector.
- C. When addressable CO detectors are installed, performing a "sensitivity" check from the panel shall report the approximate number months of sensor life remaining.
- D. The system shall provide a report that gives a listing of the sensitivity of all of the detectors on any given panel in the system, or any given analog/addressable device loop within any given panel.
- E. The system shall provide a report that gives a chronological listing of at least the last 1000 system events.
- F. The system shall provide a listing of all of the firmware revision listings for all of the installed components in the system.

2.1.4. Signaling Line Circuits

2.1.4.1. Fire Network Wiring

- A. The network inter panel wiring shall be Class B. The network media shall be copper except where fiber optic cable is specified on the drawings.
- B. The system supplied under this specification shall utilize node to node, direct wired peer-to-peer network operations. The system shall utilize independently addressed, smoke detectors, heat detectors and input/output modules <intrusion detection> as described in this specification. The peer-to-peer network shall contain multiple nodes consisting of the command center, main controller, remote control panels, LCD/LED annunciation nodes, and workstations. Each node is an equal, active functional node of the network, which is capable of making all local decisions and generating network tasks to other nodes in the event of node failure or communications failure between nodes.
C. When a network is wired in a Class B configuration, a single break or short on the network wiring isolates the system into two groups of panels. Each group continues to function as a peer-to-peer network working with their combined databases. When wired using a Class A configuration, a single break or short on the network wiring causes the system to isolate the fault, and network communication continues uninterrupted, without any loss of function. Should multiple wiring faults occur, the network re-configures into many sub-networks and continues to respond to alarm events from every panel that can transmit and receive network messages.

2.1.4.2. System

- A. The signaling line circuit connecting panels/nodes to intelligent addressable devices including, detectors, monitor modules, control modules, isolation modules, intrusion detection modules and notification circuit modules shall be Class B (style 4). All signaling line circuits shall be supervised and power limited.
- B. When the addressable devices on a signaling line circuit cover more than one designated fire/smoke compartment, a wire-to-wire short on the circuit shall not affect the operation of the addressable devices in other fire/smoke compartments.
- C. Each SLC shall support 125 addressable detector addresses and 125 module addresses. The SLC shall support 100% of all addressable devices in alarm and provide support for a 100% compliment of detector isolator bases. Initial circuit loading shall not exceed 80% in order to allow for future system expansion.
- D. T-taps (branching) shall be permitted on Class B circuits. Where possible, the devices installed at the end of each branch should be easily accessible for troubleshooting, e.g. a pull station at normal mounting height.
- E. The addressable device SLC module shall be UL Listed for use with code compliant, electrically sound existing wiring.
- F. Each intelligent addressable device shall transmit information about its location with respect to other devices on the circuit. This information shall be used to create an "As-Built" wiring diagram as well as provide enhanced supervision of a device's physical location. The device message and programmed system output function shall be associated with the device's location on the SLC circuit location and not a device address.
- G. The SLC module shall allow replacement of "same type" devices without the need to address and reload the "location" parameters on replacement device.
- H. The SLC/Panels shall notify the user when programmed devices are detected on the SLC circuit. The SLC/Panels shall notify the user when the wrong device type is installed at a location configured for a different device type on the SLC circuit.
- Should an SLC Controller CPU fail to communicate, the SLC circuit shall go into the stand-alone mode. The circuit shall be capable of producing a loop alarm if an alarm type device becomes active during stand-alone mode to enhance system integrity.

2.1.5. Notification Appliance Circuits

2.1.5.1. Notification Appliance Circuits

General

All notification circuits shall be supervised and power limited. Non-power limited circuits are not acceptable. All notification appliance circuits shall be Class B (Style "Y").

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Initial circuit loading shall not exceed 80% in order to allow for future system expansion.

24 VDC Notification Appliance circuits

Notification appliance circuits shall have a minimum circuit output rating of 2 amps @ 24 VDC

24VDC NACs shall be polarized and provide both strobe synchronization and a horn silence signals on a single pair of wires.

Audio Notification Appliance Circuits

Audio notification appliance circuits shall be polarized and have a minimum circuit output rating of 50 watts @ 25V audio, and 35 watts @ 70V audio.

2.1.5.2. Audio Amplifiers

- A. Each audio power amplifier shall have integral audio signal de-multiplexers, allowing the amplifier to select any one of eight digitized audio channels as directed by system programming.
- B. Audio amplifiers shall be power limited and protected from short circuits conditions on the audio circuit wiring. Each amplifier output shall provide a selectable 25/70 Vrms output, suitable for connection to emergency speakers.
- C. To enhance system survivability in the event of a total loss of audio data communications, all amplifiers shall default to the local "EVAC" tone generator channel. If the local panel has an alarm condition, then all amplifiers will sound the EVAC message on their speaker circuits. In the event of a loss of the fully digitized, multiplexed audio riser data, the audio amplifiers shall automatically default to an internally generated alarm tone which shall sound a 3-3-3 temporal pattern.
- D. Amplifiers shall also include a 24 VDC notification appliance circuit rated at 24Vdc @ 3.5A for connection of visible (strobe) appliances. This circuit shall be fully programmable.
- E. Provide as minimum, one twenty (20) watt audio amplifier per paging zone. Initial amplifier loading shall not exceed 80% in order to allow for future system expansion. Calculations shall assume each speaker is connected at one (1) watt.

2.1.6. Off Premises Communications

2.1.6.1. DACT

- A. The system shall provide off premises communications capability using a Digital Alarm Communications Transmitter (DACT) for sending system events to multiple Central Monitoring Station (CMS) receivers over conventional telephone lines.
- B. The system shall provide the CMS(s) with point identification of system events using 4/2, Contact ID (SIA DC-05) or SIA DCS protocols. <The system shall also transmit an alphanumeric system activity message, by event, to a commercial paging system provided by the owner, using TAP Pager protocol and an internal V.32BIS or greater 14.4Kbaud modem.>
- C. The dialer shall support up to 255 individual accounts and to send account information to eight (8) different receivers, each having a primary and secondary telephone access number. System events shall be capable of being directed to one or more receivers depending on event type or location as specified by the system design.
- D. In the event of a fire alarm panel CPU failure during a fire alarm condition, the DACT degrade mode shall transmit a general fire alarm signal to the CMS.

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> E. Provide a dual path Bosch fire alarm communicator as required to interface with the Alabama National Guard monitoring service with the DACT. Provide all necessary antennas and interfaces as required to interface with the Alabama National Guard monitoring service

2.2. Remote Booster Power Supply

2.2.1. Remote Booster Power Supply

- A. Install Remote NAC Power Supplies (boosters) at the locations shown on the drawings, as required, to minimize NAC voltage drops. Remote NAC power supplies shall be treated as peripheral NAC devices and shall not be considered fire alarm control units.
- B. The NAC power supplies shall be fully enclosed in a surface mounted steel enclosure with hinged door and cylinder lock, and finished in red enamel. Door keys shall be the identical to FACP enclosure keys. The enclosure shall have factory installed mounting brackets for additional UL listed fire alarm equipment within its cabinet. Enclosures shall be sized to allow ample space for interconnection of all components and field wiring, and up to 10AH batteries. The enclosure shall have provisions for an optional tamper switch. All FACP addressable control modules required to initiate the required NAC power supply output functions shall be installed within the NAC power supply enclosure
- C. Remote NAC power supply *input* circuits shall be configurable as Class B supervised inputs or for connection to any 6 to 45 VDC initiation source.
- D. Remote booster power supplies shall provide four (4) synchronized Class B supervised or two (2) Class A, power limited, 24VDC filtered and regulated Notification Appliance Circuits (NACs). Each NAC output shall be configurable as a continuous 24Vdc auxiliary power output circuit. The booster power supply shall be capable of a total output of 10 amps.
- E. The power supply NACs shall be configurable to operate independently at any one of the following rates: continuous synchronized, or 3-3-3 temporal. It shall be possible to configure the NACs to follow the main FACP NAC or activate from intelligent addressable synchronized modules. All visible NACs within the facility shall be synchronized.
- F. Upon failure of primary AC power, the remote power supply shall automatically switch over to secondary battery power without losing any system functions. It shall be possible to delay reporting of an AC power failure for up to 6 hours. All standby batteries shall be continuously monitored by the power supply. Low battery and disconnection of battery power supply conditions shall immediately annunciated as locally as battery trouble. All power supply trouble conditions (DC power failure, ground faults, low batteries, and IDC/NAC circuit faults) shall identify the specific remote power supply affected at the main FACP. All power supply trouble conditions except loss of AC power shall report immediately. Interconnecting NAC Booster power supplies in a manner which prevents identification of an individual power supply trouble shall not be considered as an equal.
- G. The remote booster power supply shall be capable of recharging up to 24AH batteries to 70% capacity in 24 hours maximum. Batteries provided shall be sized to meet the same power supply performance requirements as the main FACP, as detailed elsewhere in this specification.
- H. All AC power connections shall be to the building's designated dedicated emergency electrical power circuit. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each remote NAC power supply the disconnect serves.

2.3. Annunciators

2.3.1. Local Operating Console

- A. Provide a UL864 listed semi-flush mounted local operating consoles at the location(s) shown on the drawings.
- B. The LOC shall utilize standard fire alarm user interface components to provide the ability to operate the Autonomous Control Unit/Fire Alarm Control Panel functions from alternate locations within the building. The LOC shall be capable of receiving the same event information and issuing the same system commands as the ACU/FACP to which it is connected, as specified in the functional matrix elsewhere in this specification. Functions shall include initiating all pre-recorded messages and live page messages.
- C. The following common indicators and controls shall be provided on the LOC. The LOC shall include an integral LCD text annunciator. The LOC shall include an integral remote microphone for fire audio system paging. LOC Power, System Trouble, and Signal Silenced LEDs; System Reset, Silence, Trouble Silence, Drill and Lamp Test push buttons.
- D. The LOC shall be equipped with a key locked see-through door mounting. The LOC shall be powered by a battery backed up nominal 24 VDC power source.

2.4. Peripheral Components

2.4.1. Addressable Detectors

General Requirements for Intelligent Addressable Heat, Smoke and CO Detectors

- A. Each detector shall contain an integral microprocessor which shall determine if the device is normal, in alarm, or has an internal trouble. The microprocessor's non-volatile memory shall permanently store the detector's serial number, device type and system address. It shall be possible to address each intelligent device without the use of switches. Devices requiring switches for addressing shall not be considered as equal. Memory shall automatically be updated with the hours of operation, last maintenance date, number of alarms and troubles, time of last alarm, and analog signal patterns for each sensing element just before the last alarm.
- B. Each detector shall be capable of identifying up to 32 diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector.
- C. Each addressable detector on the Signaling Line Circuit (SLC) shall transmit information regarding its location with respect to other intelligent devices on the signaling line circuit to the control panel, creating an "As-Built" circuit map. The circuit mapping function shall provide location supervision of all intelligent devices on the signaling line circuit. An intelligent detector's programmed system response functions shall be associated with the detector's actual *location* on the signaling line circuit and *not with the detector's address*. After system commissioning, detectors improperly installed in the wrong location shall function according to the mapped programmed response for its *location* on the circuit, not its detector's address.
- D. A status indicator shall be provided on each detector. Flashing green shall indicate normal operation; flashing RED shall indicate the alarm state. The indicator shall be visible from any direction.
- E. The system shall allow for changing of detector types for service replacement purposes without the need to reprogram the system. The replacement detector type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it

replaced, without the need for reprogramming. System shall display an off-normal condition until the proper detector type is installed or a change in the device type profile has been made.

- F. Detectors shall be rated for operation in the following environment unless specifically noted:
 □ Temperature: 32°F to 120°F (0°C to 49°C)
 - □ Humidity: 0-93% RH, non-condensing
- G. Detectors with addressing components in the base shall not be considered as equal.

2.4.1.2. Photo-Heat-CO Detector

- A. Provide analog/addressable combination photoelectric smoke-heat and carbon monoxide (CO) detectors at the locations shown on the drawings.
- B. The combination smoke-heat & CO detector shall provide two independent signals (fire & CO) to the control panel for programming system responses. When mounted in a sounder base, the detector shall be capable of initiating a temporal 3-3-3 when smoke or heat is detected or temporal 4-4-4 when CO is detected. Detectors that transmit a common signal for both fire and CO alarms shall not be considered as equal. The detector shall be listed under standards UL-268 and UL-2075.
- C. Each smoke-heat detector shall be individually programmable to operate at any one of five (5) sensitivity settings. The detector shall also store pre-alarm and alternate pre-alarm sensitivity settings. Pre alarm sensitivity values shall be configurable in 5% increments of the alarm and alternate alarm sensitivity settings respectively. The detector shall be able to differentiate between a long term drift above the pre alarm threshold and fast rise above the threshold. The detector shall monitor the sensitivity of the smoke sensor. If the sensitivity shifts outside the UL limits, a trouble signal shall be sent to the panel. It shall be possible to automatically change the sensitivity of individual intelligent addressable smoke detectors for day and night (alternate) periods.
- D. Each detector shall utilize an environmental compensation algorithm that shall automatically adjust for background environmental conditions such as dust, temperature, and pressure. The detector shall provide a maintenance alert signal when 80% (dirty) of the available compensation range has been used. The detector shall provide a dirty fault signal when 100% or greater compensation has been used.
- E. A low mass thermistor shall act as fixed temperature 130 to 140 °F (54 to 60 °C) heat sensors.
- F. The electro-chemical CO sensor shall generate a CO alarm in compliance with the UL-2034 requirements. The sensor shall have a nominal six-year life. When the sensor approaches the end of its useful life, it shall transmit a maintenance condition to the control panel, indicating the CO sensor board replacement is required. Only when the sensor is no longer operational shall a trouble condition be sent to the control panel. Sensors that transmit a common trouble indication for both sensor end-of-life and other causes of detector trouble shall not be considered as equal. Performing a "sensitivity" check from the panel shall report the approximate number months of CO sensor life remaining.
- G. Placing the CO detector in test mode shall facilitate the use of direct injection of small quantities of CO to check detector functionality.

2.4. 1.3. Photo-CO Detector

A. Provide analog/addressable combination photoelectric smoke and carbon monoxide (CO) detectors at the locations shown on the drawings.

- B. The combination smoke and CO detector shall provide two independent signals (smoke & CO) to the control panel for programming system responses. When mounted in a sounder base, the detector shall be capable of initiating a temporal 3-3-3 when smoke is detected or temporal 4-4-4-4 when CO is detected. Detectors that transmit a common signal to the control panel for both smoke and CO alarms shall not be considered as equals. The detector shall be listed under standards UL-268 and UL-2075.
- C. Each smoke detector shall be individually programmable to operate at any one of five (5) sensitivity settings. The detector shall also store pre-alarm and alternate pre-alarm sensitivity settings. Pre alarm sensitivity values shall be configurable in 5% increments of the alarm and alternate alarm sensitivity settings respectively. The detector shall be able to differentiate between a long term drift above the pre alarm threshold and fast rise above the threshold. The detector shall monitor the sensitivity of the smoke sensor. If the sensitivity shifts outside the UL limits, a trouble signal shall be sent to the panel. It shall be possible to automatically change the sensitivity of individual intelligent addressable smoke detectors for day and night (alternate) periods.
- D. Each detector shall utilize an environmental compensation algorithm that shall automatically adjust for background environmental conditions such as dust, temperature, and pressure. The detector shall provide a maintenance alert signal when 80% (dirty) of the available compensation range has been used. The detector shall provide a dirty fault signal when 100% or greater compensation has been used.
- E. The electro-chemical CO sensor shall generate a CO alarm in compliance with UL-2034 requirements. The sensor shall have a nominal six-year life. When the sensor approaches the end of its useful life, it shall transmit a maintenance condition to the control panel, indicating the CO sensor board replacement is required. Only when the sensor is no longer operational shall a trouble condition be sent to the control panel. Sensors that transmit a common trouble indication for both sensor end-of-life and other causes of detector trouble shall not be considered as equal. Performing a "sensitivity" check from the panel shall report the approximate number months of CO sensor life remaining.
- F. Placing the CO detector in test mode shall facilitate the use of direct injection of small quantities of CO to check detector functionality.

2.4.1.4. Heat-CO Detector

- A. Provide analog/addressable combination heat and carbon monoxide (CO) detectors at the locations shown on the drawings.
- B. A Low mass thermister shall provide a 135°F (57°C) fixed-temperature heat sensing for the detection of heat due to fire. The sensor monitors the temperature of the surrounding air and determines whether an alarm should be initiated.
- C. The combination heat and CO detector shall provide two independent signals (fire & CO) to the control panel for programming system responses. When mounted in a sounder base, the detector shall be capable of initiating a temporal 3-3-3 when heat is detected or temporal 4-4-4-4 when CO is detected. Detectors that transmit a common signal to the control panel for both heat and CO alarms shall not be considered as equals. The detector shall be listed under standards UL-521 and UL-2075.
- D. The electro-chemical CO sensor shall generate a CO alarm in compliance with UL-2034 requirements. The sensor shall have a nominal six-year life. When the sensor approaches the end of its useful life, it shall transmit a maintenance condition to the control panel, indicating the CO sensor board replacement is required. Only when the sensor is no longer operational shall a trouble condition be sent to the control panel. Sensors that transmit a common trouble indication

for both sensor end-of-life and other causes of detector trouble shall not be considered as equal. Performing a "sensitivity" check from the panel shall report the approximate number months of CO sensor life remaining.

E. Placing the CO detector in test mode shall facilitate the use of direct injection of small quantities of CO to check detector functionality.

2.4.1.5. Photo-Heat Detector

- A. Provide analog/addressable combination photoelectric smoke-heat detectors at the locations shown on the drawings.
- B. When mounted in a sounder base, the detector shall be capable of initiating a temporal 3-3-3 when smoke or heat is detected.
- C. Each smoke-heat detector shall be individually programmable to operate at any one of five (5) sensitivity settings. The detector shall also store pre-alarm and alternate pre-alarm sensitivity settings. Pre alarm sensitivity values shall be configurable in 5% increments of the alarm and alternate alarm sensitivity settings respectively. The detector shall be able to differentiate between a long term drift above the pre alarm threshold and fast rise above the threshold. The detector shall monitor the sensitivity of the smoke sensor. If the sensitivity shifts outside the UL limits, a trouble signal shall be sent to the panel. It shall be possible to automatically change the sensitivity of individual intelligent addressable smoke detectors for day and night (alternate) periods.
- D. Each detector shall utilize an environmental compensation algorithm that shall automatically adjust for background environmental conditions such as dust, temperature, and pressure. The detector shall provide a maintenance alert signal when 80% (dirty) of the available compensation range has been used. The detector shall provide a dirty fault signal when 100% or greater compensation has been used.
- E. Three low mass thermistor shall act as fixed temperature 130 to 140 °F (54 to 60 °C) heat sensors and at a temperature rate-of-rise alarm point of 15°F per minute.

2.4. 1.6. Photoelectric Detector

- A. Provide analog/addressable photoelectric smoke detectors at the locations shown on the drawings.
- B. When mounted in a sounder base, the detector shall initiate a temporal 3-3-3 when smoke is detected.
- C. The photoelectric smoke detector shall be suitable for direct insertion into air ducts up to 3 ft (0.91m) high and 3 ft (0.91m) wide with air velocities up to4,000 ft/min. (0-25.39 m/sec) without requiring specific duct detector housings or supply tubes.
- D. Each smoke detector shall be individually programmable to operate at any one of five (5) sensitivity settings. The detector shall also store pre-alarm and alternate pre-alarm sensitivity settings. Pre alarm sensitivity values shall be configurable in 5% increments of the alarm and alternate alarm sensitivity settings respectively. The detector shall be able to differentiate between a long term drift above the pre alarm threshold and fast rise above the threshold. The detector shall monitor the sensitivity of the smoke sensor. If the sensitivity shifts outside the UL limits, a trouble signal shall be sent to the panel. It shall be possible to automatically change the sensitivity of individual intelligent addressable smoke detectors for day and night (alternate) periods.

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E. Each detector shall utilize an environmental compensation algorithm that shall automatically adjust for background environmental conditions such as dust, temperature, and pressure. The detector shall provide a maintenance alert signal when 80% (dirty) of the available compensation range has been used. The detector shall provide a dirty fault signal when 100% or greater compensation has been used.

2.4.1.7. Duct Smoke Detector

- A. Provide intelligent low profile photoelectric duct smoke detectors / remote test switches at the locations shown on the drawings.
- B. The intelligent duct smoke detector shall operate in ducts having from 100ft/min to 4,000ft/min air velocity. The detector shall be suitable for operation over a temperature range of -20 to 158F° and offer a harsh environment gasket option. The detector shall utilize an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten (10) feet. Design of the detector shall permit sampling tube installation from either side of the detector and permit sampling tube installation in 45- degree increments to ensure proper alignment with duct airflow. Drilling templates and gaskets to facilitate locating and mounting the housing shall be provided.
- C. The intelligent duct smoke detector shall obtain information from a photoelectric sensing element. The detector shall be able to differentiate between a long term drift above the pre alarm threshold and fast rise above the threshold. The detector shall monitor the sensitivity of the smoke sensor. If the sensitivity shifts outside the UL limits, a trouble signal shall be sent to the panel
- D. Each detector shall utilize an environmental compensation algorithm that shall automatically adjust for background environmental conditions such as dust, temperature, and pressure. The detector shall provide a maintenance alert signal when 80% (dirty) of the available compensation range has been used. The detector shall provide a dirty fault signal when 100% or greater compensation has been used.
- E. The intelligent duct smoke detector shall provide a form "C" auxiliary alarm relay rated at 2amps @ 30Vdc. The position of the relay contact shall be supervised by the control panel software. Operation of the relay shall be controlled either by its respective detector processor or under program control from the control panel as required by the application. Detector relays not capable of programmed operation independent of the detector's state shall not be considered as equal. The detector shall be equipped with a local magnet-activated test switch.
- F. Each duct detector shall be installed and testing in accordance with manufacturer's instructions, including pressure differential and, velocity testing. Test results shall be submitted to the owner.
- G. Remote test switches/LED indicators shall be provided below the detector on the ceiling to indicate location of the detector in non-mechanical areas, at locations indicated on the drawings.

2.4.1.8. Fixed Heat Detector

- A. Provide intelligent fixed temperature heat detectors at the locations shown on the drawings.
- B. The detector shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The detector shall utilize a low mass thermistor heat sensor and operate at a nominal fixed temperature alarm point rating of 135°F (57°C). The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of thermistor data. Systems using central intelligence for alarm decisions shall not be considered as equal.
- C. The heat detector shall be rated for ceiling installation at a minimum of 50 ft (15.24m) centers and also be suitable for wall mount applications.

2.4.1.1.9. Rate of Rise Detector

- A. Provide intelligent combination fixed temperature / rate-of-rise heat detectors at the locations shown on the drawings.
- B. The detector shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The detector shall utilize a low mass thermistor heat sensor and operate at a nominal fixed temperature alarm point rating of 135°F and at a temperature rate-of-rise alarm point of 15°F per minute. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of thermistor data. Systems using central intelligence for alarm decisions shall not be considered as equal.
- C. The heat detector shall be rated for ceiling installation at a minimum of 50 ft centers and also be suitable for wall mount applications.

2.4.1.10. CO Detector

- A. Provide addressable carbon monoxide (CO) detectors at the locations shown on the drawings.
- B. The CO detector shall provide a signal to the control panel for programming system responses. When mounted in a sounder base, the detector shall be capable of initiating a temporal 4-4-4-4 signal when CO is detected. The detector shall be listed under standard UL-2075.
- C. The electro-chemical CO sensor shall generate a CO alarm in compliance with UL-2034 requirements. The sensor shall have a nominal six-year life. Performing a "sensitivity" check from the panel shall report the approximate number months of sensor life remaining. When the sensor approaches the end of its useful life, it shall transmit a maintenance condition to the control panel, indicating the CO sensor board replacement is required. Only when the sensor is no longer operational shall a trouble condition be sent to the control panel. Detectors that transmit a common trouble indication for both sensor end-of-life and other causes of detector trouble shall not be considered as equal.
- D. Placing the CO detector in test mode shall facilitate the use of direct injection of small quantities of CO to check detector functionality.

2.4.1.11. Standard Base

- A. Provide standard detector bases suitable for mounting on either North American 1-gang, 3½ or 4 inch octagon box and 4 inch square box, European BESA or 1-gang box.
- B. The bases shall utilize a twist-lock design and provide screw terminals for all field wiring connections.
- C. The base shall contain no active electronics and support all Signature series detector types.
- D. The base shall be capable of supporting a Remote Alarm LED Indicator. Provide remote LED alarm indicators where shown on the plans.
- E. Removal of the respective detector shall not affect communications with other detectors.

2.4.1.12. Relay Base

A. Provide relay detector bases suitable for mounting on either North American 1-gang, 3½ or 4 inch octagon box and 4 inch square box, European BESA or 1-gang box; at the locations shown on

the drawings.

- B. The bases shall utilize a twist-lock design and provide screw terminals for all field wiring connections.
- C. The base shall contain no electronics and support all Signature series detector types.
- D. Removal of the respective detector shall not affect communications with other detectors.
- E. The relay base shall meet the following requirements:
 - The relay shall be a bi-stable type and selectable for normally open or normally closed operation.
 - 2. The position of the relay contact shall be supervised.
 - The operation of the base relay shall be configurable for control by its respective detector or for independent programmable control from the fire alarm panel. Relay bases not configurable for detector or panel operation shall not be considered equal.
 - 4. The base relay shall provide form "C" contacts with a minimum rating of 1 amp @ 30 Vdc and be listed for pilot duty.

2.4.1.13. Sounder Base

- A. Provide audible detector mounting bases suitable for mounting on a North American 1-gang, 3½ or 4 inch octagon box and 4 inch square box, or European BESA or 1-gang box; at the locations shown on the drawings.
- B. The bases shall utilize a twist-lock design and provide screw terminals for all field wiring connections.
- C. Removal of the respective detector shall not affect communications with other detectors.
- D. The audible base shall support all detector types and shall be capable of single or group operation.
- E. The audible base shall emit a temporal 3-3-3 fire alarm tone when smoke or heat has been detected. The audible base shall emit a temporal 4-4-4-4 CO alarm tone when CO has been detected. The outputs shall be configurable for low or high output by moving a reversible jumper. The system shall be UL2017 listed for dual signaling for this purpose.
- F. The audible bases shall provide a UL-268 reverberant room sound output of 90.8 dBA at 10ft (3m) for temporal 3-3-3 fire alarm and 84.1 dBA at 10 ft.(3m) for temporal 4-4-4-4 CO alarm.

2.4.1.14. Smoke Detector Guards

- A. Smoke detector guards shall be installed at the locations shown on the drawings.
- B. The guards shall be UL tested and listed by for use with the smoke detectors they protect. Guard design shall not affect the detector operating sensitivity and shall not reduce the listed detector spacing.
- C. The design of the guard shall provide physical protection for the detector while preventing looped items from hanging on the guard when wall mounted or being threaded through the guard.
- D. The guards shall be constructed of 16-gauge steel with a baked white finish to match the detectors. Tamperproof mounting hardware shall be provided.

2.4.1.2. Manual Stations

2.4.1.2.1. Double Action Two Stage

- A. Provide addressable single action, two stage fire alarm stations at the locations shown on the drawings.
- B. The manual station shall be suitable for mounting on North American 2 ½ (64mm) deep 1-gang boxes and 1 ½ (38mm) deep 4 square boxes with 1-gang covers. If indicated as surface mounted, provide manufacturer's surface back box.
- C. The fire alarm station shall be of lexan construction, shall be finished in red with silver "PULL IN CASE OF FIRE" lettering, shall show visible indication of operation and incorporate an internal toggle switch for first stage alarm and key switch for second stage alarm.
- D. The manual pull station will have an addressable module integral to the unit.
- E. Manual pull stations that initiated an alarm condition when opening the unit are not acceptable.

2.4.1.2.2. Guards

- A. Provide manual pull station guards at the locations shown on the drawings.
- B. The guard shall consist of a factory-fabricated clear polycarbonate enclosure, hinged at the top. Lifting the cover shall provide access to the manual pull station and activate an integral battery powered audible horn intended to discourage false alarms.

2.4.1.3. Modules

2.4.1.3.1. General

- A. Intelligent addressable multifunction modules shall be provided at the locations shown on the drawings to provide the specific system input and output functions described by the operation section and functional matrix found elsewhere in this specification.
- B. The operation of multifunction modules shall be software configurable at the site to meet operational conditions, and may be changed at any time by download changes from the control panel. The intelligent multifunction modules shall utilize electronic addressing. Modules using rotary or DIP switches, memory chips and / or jumpers for addressing shall not be considered as equal.
- C. Each intelligent multifunction module on the Signaling Line Circuit (SLC) shall transmit information regarding its location with respect to other intelligent devices on the signaling line circuit to the control panel, creating an "As-Built" circuit map. The circuit mapping function shall provide location supervision of all intelligent devices on the signaling line circuit. An intelligent device's programmed system response functions shall be associated with the device's actual *location* on the signaling line circuit and *not with the device's address*. After system commissioning, devices improperly installed in the wrong location shall function according to the mapped programmed response for its *location* on the circuit, not its device address.
- D. All input /output status decisions shall be made by the microprocessor within the module. Communications with a control panel shall not be required in order for the module to identify offnormal input/output conditions. Modules with supervised input or output circuits shall be capable of identifying ground fault conditions down to the module address level.
- E. Each module shall be equipped with two (2) diagnostic indicators; a green LED to confirm communications and a red LED to display active status. LEDs shall be visible through the finished cover plate. The module shall be capable of storing a unique serial number and up to 24

diagnostic codes, hours of operation, number of atarms and troubles, and time of last alarm in its memory which can be retrieved for troubleshooting.

- F. Modules shall be rated for operation in the following environment:
 - Temperature: 32°F to 120°F (0°C to 49°C)
 - Humidity: 0-93% RH, non-condensing
- G. Where multiple modules are mounted in close proximity to each other, plug-in modular versions of the modules and motherboards shall be available to minimize field wiring and facilitate troubleshooting.
- H. The addressable multifunction modules shall EDWARDS Signature Series devices.

2.4.1.3.2. Single Input Monitor

- A. Provide addressable single input multifunction modules at the locations shown on the drawings.
- B. The module shall be suitable for mounting on North American 2½" (64mm) deep 1-gang boxes and 1½" (38mm) deep 4" square boxes with 1-gang covers.
- C. Each module shall provide one (1) supervised Class B input circuit configurable as one of the following "personalities."
 - 1. Normally-Open Alarm Latching (for alarm initiation applications)
 - 2. Normally-Open Alarm Delayed Latching (for waterflow switch applications)
 - 3. Normally-Open Active Non-Latching (for limit switch and monitor applications)
 - 4. Normally-Open Active Latching (for tamper switch and supervisory applications)
 - C. Each module shall identify and report by device address, ground faults and opens associated with its initiating device circuit, to the control panel. Single function modules or without individual ground fault detection identification capability shall not be considered as equal.

2.4.1.3.3. Dual Input Monitor

- A. Provide addressable dual input multifunction modules at the locations shown on the drawings.
- B. The module shall be suitable for mounting on North American 2¹/₂" (64mm) deep 1-gang boxes and 1¹/₂" (38mm) deep 4" square boxes with 1-gang covers.
- C. Each module shall provide two (2) supervised Class B input circuit configurable as one of the following "personalities."
 - 1. Normally-Open Alarm Latching (for alarm initiation applications)
 - 2. Normally-Open Alarm Delayed Latching (for waterflow switch applications)
 - 3. Normally-Open Active Non-Latching (for limit switch and monitor applications)
 - 4. Normally-Open Active Latching (for tamper switch and supervisory applications)
 - C. Each module shall identify and report by device address, ground faults and opens associated with its initiating device circuits, to the control panel. Single function modules or without individual ground fault detection identification capability shall not be considered as equal.

2.4.1.3.4. Notification Circuit

A. Provide addressable notification appliance circuit modules at the locations shown on the drawings.

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- B. The module shall be suitable for mounting in North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes.
- C. The addressable NAC module shall provide one (1) supervised Class B notification appliance circuit.
- D. The NAC control module shall be configurable for the following operations:
 - 24 VDC synchronized NAC circuit, 2 amps @ 24 VDC.
 - Audio notification circuit 25Vrms @ 50 watts or 70 Vrms @ 35 watts

2.4.1.3.5. Relay

- A. Provide addressable control relay modules at the locations shown on the drawings.
- B. The module shall be suitable for mounting on a North American 2 ½" (64mm) deep 1-gang box or 1 ½" (38mm) deep 4" square box with 1-gang covers.
- C. The module shall provide one (1) form C dry relay contacts rated at 24Vdc @ 2 amps (pilot duty) to control external appliances or equipment. The position of the relay contact shall be confirmed by the system firmware. The relay coil shall be magnetically latched to reduce wiring and ensure 100% of the relays on the SLC can be energized at same time.

2.4.1.3.6. Waterflow-Tamper

- A. Provide addressable dual input waterflow / tamper modules at the locations shown on the drawings.
- B. The module shall be suitable for mounting on North American 2¹/₂" (64mm) deep 1-gang boxes and 1¹/₂" (38mm) deep 4" square boxes with 1-gang covers.
- C. Each module shall provide two (2) supervised Class B input circuit configured as:
 - 1. Normally-Open Alarm Delayed Latching for waterflow switch applications.
 - 2. Normally-Open Active Latching for tamper switch and supervisory applications.
 - C. Each module shall identify and report by device address, ground faults and opens associated with its initiating device circuits, to the control panel. Modules or without individual ground fault detection identification capability shall not be considered as equal.

2.4.1.3.7. Isolation Module

- A. Provide addressable isolator modules at the locations shown on the drawings.
- B. The module shall be suitable for mounting on North American 2¹/₂" (64mm) deep 1-gang boxes and 1¹/₂" (38mm) deep 4" square boxes with 1-gang covers.
- C. In the event the Class A signaling line circuit on which the intelligent isolator module is installed is shorted, each module shall open the SLC. Isolator modules shall then sequentially reconnect the isolated circuit segments until only the segment with the short is left out of the circuit, leaving the balance of the circuit operational.

2.4.1.3.8. Universal Modules

- A. Provide intelligent universal Class A/B multifunction modules at the locations shown on the drawings.
- B. The module shall be suitable for mounting on North American 21/2" (64mm) deep 2-gang boxes

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and 11/2" (38mm) deep 4" square boxes with 2-gang covers.

C. Each universal module shall be configurable as one of the following "personalities."

1. Two (2) supervised Class B Normally-Open Alarm Latching. (for alarm initiation applications)

2. Two (2) supervised Class B Normally-Open Alarm Delayed Latching. (for waterflow switch applications)

3. Two (2) supervised Class B Normally-Open Active Non-Latching. (for limit switch and monitor applications)

4. Two (2) supervised Class B Normally-Open Active Latching. (for tamper switch and supervisory applications)

5. One (1) form "C" dry relay contact rated at 2 amps @ 24 Vdc. (for circuit control applications)

6. One (1) supervised Class A Normally-Open Alarm Latching. . (for alarm initiation applications)

7. One (1) supervised Class A Normally-Open Alarm Delayed Latching. . (for waterflow switch applications)

8. One (1) supervised Class A Normally-Open Active Non-Latching. (for limit switch and monitor applications)

9. One (1) supervised Class A Normally-Open Active Latching. . (for tamper switch and supervisory applications)

10. One (1) supervised Class A 2-wire Smoke Alarm Non-Verified. (for alarm initiation applications)

11. One (1) supervised Class B 2-wire Smoke Alarm Non-Verified. (for alarm initiation applications)

12. One (1) supervised Class A 2-wire Smoke Alarm Verified (for alarm initiation applications)

13. One (1) supervised Class B 2-wire Smoke Alarm Verified(for alarm initiation applications)

14. One (1) supervised Class A Signal Circuit, 24Vdc @ 2A.(for occupant notification applications)

15. One (1) supervised Class B Signal Circuit, 24Vdc @ 2A. .(for occupant notification applications)

C. Each module shall identify and report ground faults, opens and shorts associated with its supervised input / output circuits, by device address, to the control panel. Single function modules or without individual ground fault detection identification capability shall not be considered as equal.

2.4.2. Notification Appliances

2.4.2.1. General

- A. All appliances supplied for the requirements of this specification shall be UL Listed for Fire Protective Service, and shall be capable of providing the "equivalent facilitation" which is allowed under the Americans with Disabilities Act Accessibilities Guidelines (ADA(AG)), and shall be UL 1971 Listed.
- B. All appliances shall be of the same manufacturer as the fire alarm control panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturer's instructions.
- C. Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purpose intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is

100% compatible with each other for the purpose intended.

- D. All strobes shall be provided with lens markings oriented for wall mounting. Exterior mounted devices shall be provided with a weatherproof backbox.
- E. All visual appliances shall be synchronized. Light and audible output levels shall be designed to meet ADA and NFPA requirements

2.4.2.2. Low Profile

2.4.2.2.1. Strobes

- A. Provide low profile wall mounted strobes at the locations shown on the drawings.
- B. Low profile strobes shall mount in a North American 1-gang box, and protrude less than 1" from the finished wall. The word "ALERT" shall be prominently displayed on the white housing.
- C. The strobe output shall be switch selectable as required by its application from the following available settings: 15cd, 30cd, 75cd & 110cd. Selected strobe rating shall be visible when the strobe is in its installed position. Amber lens strobes shall be available with outputs of 12/24/60/88cd. Light shall be evenly distributed throughout the required volume using cavity and mask "Full Light" technology to prevent hot spots. Strobes using specular reflectors shall not be considered as equal.
- D. When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules.
- E. Horn and strobe power, horn silencing, and strobe synchronization shall be accomplished over a single pair of wires. In and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

2.4.2.2.2. Speaker-Wall

- A. Provide low profile wall mounted speakers at the locations shown on the drawings.
- B. The low profile speakers shall mount in a North American 4" x 2 1/8" square electrical box, and protrude less than 1" from the finished wall. The word "ALERT" shall be prominently displayed on the white housing.
- C. The speaker output shall be switch selectable from the following available settings: 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker is in its installed position.
- D. The speaker shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

2.4.2.2.3. Speaker-Strobe-Wall

- A. Provide low profile wall mounted speaker-strobes at the locations shown on the drawings.
- B. The low profile speaker-strobes shall mount in a North American 4" x 2 1/8" square electrical box, without trims or extension rings, and protrude less than 1" from the finished wall. The word "ALERT" shall be prominently displayed on the white housing.

- C. The speaker output shall be switch selectable from the following available settings: 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker-strobe is in its installed position.
- D. The strobe output shall be switch selectable as required by its application from the following available settings: 15cd, 30cd, 75cd & 110cd. Selected strobe rating shall be visible when the speaker-strobe is in its installed position. Amber lens strobes shall be available with outputs of 12/24/60/88cd. Light shall be evenly distributed throughout the required volume using cavity and mask "Full Light" technology to prevent hot spots. Strobes using specular reflectors shall not be considered as equal.
- E. When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules
- F. Horn and strobe power, horn silencing, and strobe synchronization shall be accomplished over a single pair of wires. Both the speaker and strobe elements shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

2.4.2.2.4. Speaker-Strobe-Ceiling

A. Provide low profile ceiling mounted speaker-strobes at the locations shown on the drawings.

Speaker-strobes shall mount in a North American 4" x 2 1/8" square electrical box, or a 960A-4RF round flush box, and protrude less than 1.6" from the finished ceiling. The word "ALERT" shall be prominently displayed on the white housing.

- B. The speaker output shall be switch selectable from the following available settings: 2W (91dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (80dBA) at 10 ft. when measured in reverberation room per UL-1480. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker-strobe is in its installed position.
- C. The strobe output shall be switch selectable as required by its application from the following available settings: 15cd, 30cd, 75cd & 95cd or 95cd, 115cd, 150cd, &177cd. Selected strobe rating shall be visible when the speaker-strobe is in its installed position. Amber lens strobes shall be available with outputs of 13/26/65/82cd or 82/100/130/155cd.
- D. When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules
- E. Strobe power and synchronization shall be accomplished over a single pair of wires. Both the speaker and strobe elements shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

2.4.2.2.5. Speaker-Strobe-Weatherproof

- A. Provide low profile weatherproof speaker-strobes at the locations shown on the drawings.
- B. The weatherproof speaker-strobes shall mount in a North American 4" square 1 ½"deep electrical box for indoor applications without a trim skirt and a and a 4" square 2 1/8"deep electrical box when used with a trim skirt. A factory supplied back box shall be supplied for weatherproof

applications.

- C. The speaker-strobe shall be suitable for wall or ceiling mount and operate in temperatures from -40 to 151 degrees F. The word ALERT shall be prominently displayed on the white housing.
- D. The speaker output shall be switch selectable from the following available settings:

Wattage	Switch Position	25Vrms	70Vrms 89.7 dBA 86.9 dBA	
2W	Т	90.0 dBA		
1W	Х	87.1 dBA		
1/2 W	γ	84.0 dBA	83.9 dBA	
1/4 W	Z	80.8 dBA	80.8 dBA	
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- E. Output is at 10 ft. when measured in reverberation room per UL-464. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker-strobe is in its installed position.
- F. The strobe output shall be switch selectable as required by its application from the following available settings:

Listing	Location	Standard Candela Output Speaker- Strobes			High Candela Output Speaker- Strobes					
		Strobe Switch Position								
		D	C	В	A	D	C	В	A	
UL 1971	Indoor, Clear lens	15 cd	29 cd	70 cd	87 cd	102 cd	123 cd	147 cd	161 cd	
UL 1971	Indoor, Amber lens	13 cd	25 cd	59 cd	62 cd	84 cd	101 cd	125 cd	130 cd	
UL 1638	Outdoor, Clear lens	6 cd	12 cd	28 cd	35 cd	41 cd	50 cd	60 cd	65 cd	
UL 1638	Outdoor, Amber lens	5 cd	10 cd	24 cd	25 cd	34 cd	41 cd	51 cd	52 cd	

- G. Selected strobe rating shall be visible when the speaker-strobe is in its installed position
- H. When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules.
- I. Horn and strobe power, horn silencing, and strobe synchronization shall be accomplished over a single pair of wires. Both the speaker and strobe elements shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

2.4.3. Accessories

2.4.3.1. Magnetic Door Holders

- A. Provide floor mounted or wall mounted fail safe electromagnetic door holders as shown on the drawings.
 - B. Holders shall provide approximately 25-lbf nominal holding force when energized. The units shall

have an aluminized finish and contain no moving parts. The contact plate shall have an integral nylon swivel to absorb shock and adjust to any door angle.

- C. Flush and semi-flush models shall be designed for concealed wiring applications and shall mount on standard 1-gang electrical box. Floor mounted electromagnet units shall consist of a floor plate, gaskets, and housing. Incoming conduit shall connect directly into floor plate. The housing and gaskets shall mount on the floor plate to form a weatherproof junction box Door holders shall be listed to UL-228.
- D. All holders shall be normally be energized, and a release shall be accomplished by interrupting the circuit.

2.4.3.2. Surge Suppression Devices

A. The system shall utilize the following electrical surge protection devices to prevent damage and nuisance alarms caused by nearby lightning strikes, stray currents, or voltage transients.

On the AC Input of all fire alarm panels and remote power supplies: SPACE AGE Model E120V-GT, or equal. AC Surge protectors shall be installed at the electrical panel board feeding the fire alarm equipment. Excess lead length shall be trimmed. The branch circuit conductor shall be formed into a 5-10 turn 1" diameter tie-wrapped coil just downstream of the suppressor connection.

On each DC fire alarm circuit entering or leaving the building: Ditek DTKxLVL series, or equal.

DC Surge protectors shall be installed on each required circuit at the point of entry into the building.

2.4.3.3 System Records Document Box

A. The contractor shall furnish and install a systems record document enclosure as mandated by NFPA 72 2013 edition chapter 7.7.2.1. The system records documents box (SRD) shall be constructed of 18 gauge cold rolled steel. It shall have a red powder coat epoxy finish. The cover shall be permanently screened with 1" high lettering and read "SYSTEMS RECORD DOCUMENTS" or "FIRE ALARM DOCUMENTS" with white indelible ink. The access door shall be locked with a 3/4 " barrel lock which is keyed the same as the manufacturers fire alarm control panel and the hinge shall be a solid width 12" stainless steel piano hinge. The enclosure will supply 4 mounting holes to securely fasten the box to a solid surface. Inside the enclosure will accommodate standard 8 1/2x11 manuals and loose document records that may be placed in a three ring binder. All documents and software will be protected within the enclosure. A legend sheet will be permanently attached to the door for system required documentation, key contacts and system information. The SRD will have securely mounted inside the enclosure a minimum of 4 Gigabyte digital flash memory drive with a standard USB type B connector for uploading and downloading electronic information. The drive shall not be accessible without tools to any person whom gains access to the enclosure. The enclosure shall also provide 2 key ring holders with a location to mount standard business type cards for key contact personnel.

3. Part 3 - Execution

3.1. Installation

3.1.1. General

- A. The entire system shall be installed in a skillful manner in accordance with approved manufacturer's installation manuals, shop drawings and wiring diagrams.
- B. All work shall be performed in accordance with the requirements of NFPA 70 and NFPA 72.

- C. Coordinate locations of all devices with all other divisions' drawings and specifications.
- D. All fire alarm devices shall be accessible for periodic maintenance. Should a device location indicated on the contract drawings not meet this requirement, it shall be the responsibility of the installing contractor to bring it, in writing, to the attention of the Project Engineer.
- E. Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.
- F. All systems and system components listed to UL864 Control Units for Fire Protective Signaling Systems may be installed within a common conduit raceway system, in accordance with the manufacture's recommendations. System(s) or system components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.
- G. No wiring except life safety system circuits and system power supply circuits shall be permitted in the control panel enclosures.
- H. Any low-voltage copper wiring that leaves the protection of a building shall be provided with a compatible UL 497B listed transient protection devices where the circuit leaves the building and where it enters the next building.
- I. Devices containing end-of-line resistors shall be appropriately labeled. Devices should be labeled such that removal of the device is not required to identify the EOL device.
- J. Fiber Optic Cable
 - 1. Only glass filament cable permitted. Plastic filament fiber optic cables are not acceptable.
 - 2. ST connectors shall be used at all equipment terminations.
- K. Concrete floors shall be X-rayed prior to core drilling on post tension slabs. Verify with engineer on type of slab prior to bid.

3.1.2. Electrical

3.1.2.1 Boxes, Enclosures And Wiring Devices

- A. Boxes shall be installed plumb and firmly in position.
- B. Extension rings with blank covers shall be installed on junction boxes where required.
- C. Junction boxes served by concealed conduit shall be flush mounted.
- D. All wiring to be in conduit sized in accordance with NEC with a minimum size of 3/4'.
- E. Provide all conduit with 3" wide red stripe every 10' for length of run.
- F. Provide all junction boxes with red cover, stencil the letters "FA" in 2" high letters on each box cover.
- G. Wiring within cabinets, enclosures, boxes, junction boxes and fittings shall be installed in a neat and workmanlike manner, installed parallel with or at right angles to the sides and back of any box, enclosure or cabinet, and routed to allow access for maintenance. All conductors that are terminated, spliced, or otherwise interrupted in any enclosure, cabinet, mounting or

junction box shall be connected to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make all connections with approved pressure type terminal blocks, which are securely mounted. All terminal block screws shall have pressure wire connectors of the self-lifting or box lug type. No more than two conductors shall be installed under one connection. Wire nuts, crimp splices and similar devices shall not be used.

3.1.2.2 Conductors

- A. Each conductor shall be identified as shown on the drawings at terminal points. Permanent wire markers shall be located within 2 inches of the wire termination. Marker text shall be visible with protective doors or covers removed.
- B. Maintain a consistent color code for fire alarm system conductor functions throughout the installation.
- C. All wiring shall be installed in compliance with the National Electric Code, NFPA 70, and the equipment manufacturer's requirements.

Wiring for Signaling Line Circuit and Initiating Device Circuit field wiring shall be solid copper, No. 18 AWG twisted pair conductors at a minimum. Speaker circuits; 16 AWG twisted pair at a minimum. 24VDC visual and audible Notification Appliance Circuits shall be solid copper No. 14 AWG size conductors at a minimum. The wiring sizes listed herein are minimum sizes. Use larger wire sizes when recommended by the manufacturer, based on system configuration and project specific calculations.

Where shielded wiring is used, the shield shall be grounded at only one point, which shall be in or adjacent to the FACP or other control equipment. Shields shall be continuous, treated as a third conductor, and insulated from ground except as noted.

T-taps (branches) are permitted in Style 4 SLC circuits with interconnections occurring on terminal strips.

Circuits to third-party systems (HVAC, Elevators, fire pumps, etc.) shall terminate in terminal cabinets within three (3) feet of the controllers for those systems. AC power wiring shall be No. 12 AWG solid copper having insulation rated for 600 volts.

Crimp type spade lugs shall be used for terminations of stranded conductors to binder screws or stud type terminals.

All wiring shall be checked and tested to insure that there are no grounds, opens or shorts.

3.1.2.3 Devices

A. All devices and appliances shall be mounted to or in an approved electrical box.

3.1.2.4 Raceways

- A. Conduits shall be sized according to the conductors contained therein. Cross sectional area percentage fill for system conduits shall not exceed 40%.
- B. Install all conductors in rigid metal conduit or electro-metallic tubing, utilizing compression type fittings and couplings, with a minimum diameter 3/4". The use of flexible metal conduit not exceeding a six (6) foot length shall be permitted for initiating device circuits.

- C. All fire alarm conduit systems shall be routed and installed to minimize the potential for physical, mechanical or fire damage, and shall not to interfere with existing building systems, facilities or equipment.
- D. Run conduit or tubing concealed in finished areas unless specifically shown otherwise on the drawings. Conduit may be exposed in unfinished mechanical/electrical rooms, and basement levels.
- E. All system conduits, junction boxes, pull boxes, terminal cabinets, electrical enclosures and device back box locations shall be readily accessible for inspection, testing, service and maintenance.

3.1.2.5 Open Cable

- A. Power Limited cable, when not installed in UL listed metal conduit or raceway, shall be mechanically protected by building construction features par NFPA 70, Article 760.
 - 1. Installation shall be in areas not subjected to mechanical injury.
 - All circuits shall be supported by the building structure. Cable shall be attached by straps or bridal rings to the building structure at intervals not greater than 10 feet. The use of staples is prohibited. Fire alarm wiring shall not be bundled or strapped to existing conduit, pipe or wire in the facility.
 - 3. Where wiring is installed above drop ceilings, cable shall not be laid on ceiling tiles.
 - 4. Cable shall not be fastened in a manner that puts tension on the cable.
- B. Power Limited Cable shall be FPLP, FPLR or FPL, or permitted substitute.

3.1.3. FA Components

3.1.3.1 Devices

- A. All devices and appliances shall be mounted to or in an approved electrical box.
- B. All wall mounted *control equipment* shall comply with requirements defined by the International Building Code and Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems (AC-156) using a seismic component importance factor of 1.5.

3.1.3.2 Fire Alarm Control Panels

- 1. Mount the enclosure with the top of the cabinet 72" above the finished floor or center the cabinet at 63", whichever is lower.
- 2. Label the fire alarm panels with the room number, electrical panel number and circuit breaker number feeding them.
- 3. Paint the handles of the dedicated circuit breakers feeding fire alarm panels red, and install handle locks.
- 4. Within the panel, all non-power limited wiring must be properly separated from power limited circuits.
- 5. Grounds shall comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.1.3.3 Remote Annunciator/LOC

1. Mount the panel; with the top of the panel 72" above the finished floor or center the panel at 63", whichever is lower.

3.1.3.4 Remote Power Supplies And Auxiliary Panels

- 1. Locate the panel or cabinet with the top of the panel 72" above the finished floor or center the panel at 63", whichever is lower.
- 2. Do not locate these panels above ceilings or where inaccessible by a person standing on the finished floor of the space.
- 3. Label the power supplies and auxiliary FACPs with the room number, electrical panel number and circuit breaker number feeding them.
- 4. Paint the handles of the dedicated circuit breakers feeding fire alarm panels red, and install handle locks.
- 5. Within the panel, all non-power limited wiring must be properly separated from power limited circuits.

3.1.3.5 Manual Pull Stations

A. Mount stations so that their operating handles are between 42" and 48" above the finished floor.

3.1.3.6 Notification Appliances

- A. All wall mounted audio/visual devices shall be mounted so the entire lens is between 80" and 96" above the finished floor. Where low ceilings exist, devices shall be mounted within 6" of the ceiling.
- B. Each speaker's (horn) output shall be set to the wattage value indicated for its specific location as shown on the drawings.
- C. Each strobe's output shall be set to the candela value indicated for its specific location as shown on the drawings.
- D. Each speaker (horn)-strobe's outputs shall be set to the wattage/candela value indicated for its specific location as shown on the drawings.
- E. Where ceiling height exceeds 30 feet, appliances shall be suspended from the ceiling to a height of 30 feet maximum above the finished floor.
- F. Appliances installed outdoors shall be UL listed for outdoor use.

3.1.3.7 Smoke Detectors

- A. Smoke and heat detector heads shall not be installed until after construction clean-up is completed. Detector heads installed prior to construction clean-up shall be cleaned by the manufacturer or replaced.
- B. Detectors located on the wall shall have the top of the detector at least 4" and not more than 12" below the ceiling.
- C. On smooth ceilings, detectors shall not be installed over 30 ft. apart in any direction.
- D. Install smoke detectors no closer than 3 ft. from air handling supply air diffusers or return air openings.
- E. Locate detectors no closer than 12" from any part of a lighting fixture.

3.1.3.8 Duct Smoke Detectors

- A. Install sampling tubes so they extend the full width of ducts exceeding 36".
- B. Detectors shall be located to facilitate ease of maintenance.
- C. All penetrations near detectors located on/in return ducts shall be sealed to prevent air entry.

3.1.3.9 End-of-Line Resistors

A. Devices containing end-of-line resistors shall be appropriately labeled.

3.1.3.10 CO Detectors

- A. Ceiling mounted CO detectors should be kept 12" from sidewalls.
- B. Wall mounted CO detectors should be at least 48" above the finished floor, but less than 6" from the ceiling.
- C. Locate at least 60" from fuel burning appliances.
- D. Install CO detectors no closer than 3 ft. from air handling supply air diffusers or return air openings.

3.1.3.11 Heat Detectors

- A. Heat detectors shall be installed in strict accordance with their UL listing and the requirements of NFPA 72.
- B. Heat detectors installed in the elevator machinery room to meet ANSI A17.1 requirements for elevator power disconnect, shall be located adjacent to each sprinkler head. Coordinate temperature rating and location with sprinkler rating and location.

3.1.3.12 Addressable Control (relay) Modules

- A. Install the module less than 3 feet from the device controlled.
- B. Orient the device mounting for best maintenance access.
- C. Label all addressable control modules as to their function.
- D. Provide a dedicated 24VDC circuit to feed all auxiliary relays required for inductive loads (auxiliary relays, door holders). Circuits shall be supervised via an end-of-line relay and addressable input module. Auxiliary relays shall not derive their power from the starter or load being controlled.

1.01 GENERAL REQUIREMENTS

A. Division One is applicable in full hereto.

1.02 JOB CONDITIONS

- A. Erosion control shall be employed during the construction period and shall include all necessary temporary measures required to prevent soil erosion from the site until permanent control and finished surfaces are installed.
- B. Erosion control measures shall be considered incidental to all construction involving land disturbing activities.

1.03 QUALITY ASSURANCE

- A. The Contractor shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, state or federal authorities having jurisdiction over the project. All required permits shall be obtained for construction operations by the Contractor.
- B. The Contractor shall comply with all Local, State, and Federal requirements.
- C. Industry Standards: ALDOT Standard Specifications for Highway Construction, unless otherwise noted.

1.04 SLOPE DRAINS

- A. Temporary slope drains not detailed on the drawings may be constructed of pipe, fiber mats, rubble, Portland cement concrete, filter fabric, bituminous concrete, or plastic sheets.
- B. Drainage fill for sediment traps shall be size 57 crushed stone meeting ASTM C33.

1.05 FILTER FABRIC

A. Silt Fences shall meet the requirements of ALDOT Specifications.

1.06 GENERAL

- A. Temporary erosion control shall be directed toward and have the purpose of controlling soil erosion at its potential source. Downstream sediment entrapment measures shall be employed, but only as a backup to primary control at the source.
- B. A continuing program of installation and maintenance of sediment control shall be employed during the construction period.

1.07 TEMPORARY EROSION CONTROL DURING CONSTRUCTION

- A. Temporary erosion control construction shall be employed until such time as permanent paving, planting and restoration of natural areas is effective in control of erosion from the site.
- B. Temporary Stabilization of Entrances to construction sites:
 - 1. Stabilize defined entrance ways using stone complying with requirements of ASTM C-33 No. 2 (1 ¹/₂" to 2 ¹/₂") and filter fabric conforming to AASHTO M-288 and Sec. 810 of the Alabama Department of Transportation Specification.
 - 2. Stabilized area shall be as indicated on the drawings; if not indicated, the area shall be at least 25' wide and at least 6" thick.
 - 3. Maintain the entrance way in such a manner as to prevent tracking or flowing of sediment onto existing paved road. This may require periodic additional top dressing of stone as conditions demand. Repair and/or clean out all facilities employed to trap sediment. Immediately clean up and remove all sediment spilled, dropped, washed or tracked onto pavement.
- C. Sediment Barriers:
 - 1. Temporary sediment barriers shall be located at all points where surface water flows from a construction area. This includes the entire perimeter of the construction area where the slope is outward and at inlets to all drainage structures.
 - 2. Sediment barriers shall be constructed to remove sediments from flowing water through filtration and sedimentation. Primary filter media will consist of silt fences utilizing anchored filter cloth. Straw bales and/or crushed stone staked or otherwise securely held in place may be used for supplemental silt barriers where deemed necessary.
 - 3. Sediment barriers shall be arranged to create ponding between them. Provisions shall be made for removing accumulated sediments and maintaining ponding capacity.
 - 4. Sediment barriers shall be removed and the area restored when permanent erosion control is effective.
- D. Grading Operations: Grading operations shall be scheduled so that the ground surface will be disturbed for the shortest possible time before permanent construction is installed. Large areas shall be maintained as flat as practicable to minimize soil transport through surface flow. Whenever steeper slopes or abrupt changes in grade are required, a diversion or berm shall be constructed at the top of the slope to cause the surface water to flow along the diversion to a control point to be transported downslope

in a slope drain. In no case shall surface water be allowed to flow uncontrolled down slopes.

- E. Slope Drains: Temporary drains shall be provided to convey surface water down slopes. Slope drains shall be provided with an apron at their tops to anchor them and properly direct water into them. Stone or rubble shall be placed at slope drain outlets to prevent scour at these points.
- F. Storm Drainage System: As much of the permanent storm drainage system as is practicable shall be initially installed and surface water diverted into the system. The remainder of the storm drainage system shall be installed as soon as conditions will allow.
 - 1. Temporary sediment barriers shall be maintained around drainage structures until final subgrade preparation is begun.
- G. Ground Cover
 - 1. All exposed soils sloping 7% or greater shall be protected by application of ground cover until construction of permanent surfaces begins.
 - 2. Ground cover may consist of any effective erosion preventative treatment such as straw or other mulches, stone base, plastic sheets, fiber mats, plantings, etc.
 - 3. All grassing or planting operations shall include mulching or hydroseeding as stabilization until ground cover by planting is effective.

1.08 CLEANUP AND REMOVAL

3

- A. At the time permanent erosion control is effective, temporary devices and their accumulated sediments shall be removed.
- B. If, because of the construction, accumulation of silt occurs in permanent detention basins, silt shall be removed by the Contractor.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Drainage course for slabs-on-grade.
 - 4. Fine grading, topsoiling and preparing lawn areas.
 - 5. Excavating and backfilling trenches within building lines.
 - 6. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.
 - 7. Geotechnical Reports applicable to this project.
 - 8. Preparing crushed aggregate base for pavement areas.
- B. Related Sections include the following:
 - 1. Division 2 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.
 - 2. Division 2 Section "Sodding" for placing of sod for lawn areas.

1.03 DEFINITIONS

- A. Backfill: Soil materials used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

- C. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- D. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- E. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Additional Excavation: Excavation below subgrade elevations as directed by Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- F. Fill: Soil materials used to raise existing grades.
- G. Structures: Buildings, footings, foundations, retaining walls, slabs, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- I. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.04 SUBMITTALS

- A. Material Test Reports: Submit following reports directly to Architect/Engineer from the testing services, with copy to the Contractor.
 - 1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.
 - 3. One optimum moisture density curve for each type of soil encountered.
 - 4. Verification of each footing subgrade.

1.05 QUALITY ASSURANCE

- A. Geotechnical Testing Agency: Soil testing and inspection service for quality control testing during earthwork operations shall be furnished by the Contractor. Retesting of failed test to be provided and paid for by the General Contractor.
- B. Prior to the installation or placement of concrete into in situ soil (load bearing earth), the Contractor shall receive acknowledgement from the Testing Company that the soil where the concrete is to be placed meets all compaction and other testing requirements specified and/or required by the Contractors' on-site testing agent. This approval with all drawings showing pertinent information indicating that day's work attached shall be signed and dated by the on-site Testing Agent and the Contractor's Superintendent and presented to the Architect on-site.
 - The Contractor's testing agency shall report to the contractor the results of all required tests, which shall be reviewed and acknowledges by the General Contractor and then submitted to the Architect. The General Contractor shall not submit any failed soil density concrete or other test result(s) to the Architect without including the applicable recheck test result(s) that indicate compliance with the Specifications. The recheck test result(s) shall be identified with the same number as the failed test with the notation "-R"."

1.06 PROJECT CONDITIONS

- A. Site Information: The report of subsurface investigation is bound herein. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor.
 - 1. Additional test borings and other exploratory operations may be made by Contractor at no cost to the owner.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- C. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.
- D. Recommendations made in the reports of subsurface investigation bound herewith after this section shall be a requirement of these specifications. Where conflicts occur

between the report and this specification, the more stringent requirement shall govern.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Backfill and Fill: Satisfactory soil materials.
- E. Base: Crushed aggregate base in accordance with requirements of Section 825 of the State of Alabama Department of Transportation Standard Specifications for Highway Construction, Latest Edition, unless noted otherwise.
- F. Select fill earth originating from an off-site source shall consist of a clean, non-saturated, and non-organic clayey sand or clayey gravels or sandy clays classified as SC, GC, or CL, based on the Unified Soil Classification System (USCS), having a plasticity index (PI) between 5 and 20. All fill soil shall contain less than 3 percent organics by weight and shall be free of large roots and debris.
- G. Engineered Fill: All fill earth placed in the "Controlled Areas" shall be designated as "Engineered Fill."
- H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ALDOT Section 800; coarse-aggregate grading Size 57 or 67.
- J. Topsoil: Topsoil shall be a natural, workable, friable, loamy soil, without admixture of subsoil, refuse, or foreign materials, suitable for growing grasses or other vegetative ground cover. Topsoil shall be furnished by the Contractor from an off-site source approved by the Architect if required to supplement previously stockpiled on-site

Northport FMS #9 Renovations Northport, AL topsoil.

2.02 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 2°-6° deep.
 - 1. Tape Colors: Provide tape colors to utilities as follows:

Red: Electric

Yellow: Gas, oil, steam, and dangerous materials.

Orange: Telephone and other communications.

Blue: Water systems.

Green: Sewer systems.

PART 3 EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.02 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

Northport FMS #9 Renovations Northport, AL

2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.03 EXPLOSIVES

A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.05 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 2. Excavation for Underground Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended for bearing surface.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.07 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: 12 inches on each side of pipe or conduit.

- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - 1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 - 3. Excavate trenches 6 inches deeper than elevation required in unyielding bearing material to allow for bedding course.

3.08 APPROVAL OF SUBGRADE

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- C. Proof roll subgrade under building and pavement areas with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding proof rolling shall include a minimum of 2 passes in perpendicular directions over the controlled area. Do not proof roll wet or saturated subgrades.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect.

3.09 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface

water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for record documents.
 - 3. Inspecting and testing underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Backfill trenches excavated under footings and within 18 inches of bottom of footings; fill with concrete to elevation of bottom of footings.
- C. Place and compact initial backfill material, free of particles larger than 1 inch to a height of 12 inches over the utility pipe or conduit.
 - 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- D. Coordinate backfilling with utilities testing.
- E. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.
- F. Place and compact final backfill of satisfactory soil material to final subgrade.
- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use satisfactory or structural fill.
 - 4. Under building slabs, use satisfactory or structural fill.
 - 5. Under footings and foundations, use satisfactory or structural fill.

3.14 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 3 percent of optimum moisture content.
 - 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF BACKFILLS AND FILLS

- A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - Under structures, building slabs and steps, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material at 98 percent and top 6" under pavement of existing subgrade and each layer of backfill or fill material at 100 percent.

- 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 95 percent.
- 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 90 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch.
 - 3. Pavements: plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.
- D. Topsoil: All areas disturbed by grading or other construction operations or as shown on the Site Plan, not occupied by the building or pavement, shall receive 4 inch minimum thickness topsoil from on-site stockpile or from approved off-site sources.

3.17 BASE COURSES

- A. Under pavements, place base course material on prepared subgrades.
 - 1. Compact base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 100 percent of ASTM D698 relative density.
 - 2. Shape base to required crown elevations and cross-slope grades.
 - 3. When thickness of compacted base course is 6 inches or less, place materials in a single layer.
 - 4. When thickness of compacted base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

3.18 PLANTING SOIL PREPARATION

- A. Limit subgrade to areas that will be planted in the immediate future.
- B. Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter.
- C. Spread topsoil mixture to depth required to meet thickness, grades, and elevations shown, after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen.
 - 1. Place approximately ½ the thickness of topsoil mixture required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil mixture.
 - 2. Allow for sod thickness in areas to be sodded.
- D. Preparation of Unchanged Grades: Where lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare soil as follows:
 - 1. Remove and dispose of existing grass, vegetation, and turf. Do not turn over into soil being prepared for lawns.
 - 2. Till surface soil to a depth of at least 6 inches. Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches of soil. Trim high areas and fill in depressions. Till soil to a homogenous mixture of fine texture.
 - 3. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - 4. Remove waste material, including grass, vegetation, and turf, and legally dispose of it off the Owner's property.
- E. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1-1/2 inches in any dimension, and other objects that may interfere with planting or maintenance operations.
- F. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- G. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

3.19 DRAINAGE COURSE

- A. Under slabs-on-grade, place drainage course on prepared subgrade and as follows:
 - 1. Compact drainage course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
 - 2. When compacted thickness of drainage course is 6 inches or less, place materials in a single layer.

3.20 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556. Tests will be performed at the following locations and frequencies:
 - 1. Building Slab and Pavement Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,000 sq. ft. of fill area per each foot of vertical thickness placed on the building area and one per 4,000 sq.ft. in the pavement areas, but in no case fewer than three tests.
 - 2. Trench Backfill: At least one test for each 50 feet per each 2' or vertical thickness or less of trench length, but no fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

- 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property, unless instructed otherwise by Owner.

END OF SECTION 02300

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chemical soil treatment.

1.02 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act 2019.

1.03 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
- C. Test Reports: Indicate regulatory agency approval reports when required.
- D. Manufacturer's Application Instructions: Indicate caution requirements and [____].
- E. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.
- F. Record moisture content of soil before application.
- G. Maintenance Data: Indicate re-treatment schedule.
- H. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing this type of work and:
 - Having minimum of 5 years documented experience. 1.
 - 2. Approved by manufacturer of treatment materials.
 - 3. Licensed in the State in which the Project is located.

1.05 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Provide one year installer's warranty against damage to building caused by termites.

1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Manufacturers:
 - 1. Bayer Environmental Science Corp: www.backedbybayer.com/pest-management.
 - 2. FMC Professional Solutions: www.fmcprosolutions.com/#sle.
 - 3. Syngenta Professional Products: www.syngentaprofessionalproducts.com/#sle.
 - 4. Substitutions: See Section 01 6000 Product Requirements.
- B. Toxicant Chemical: EPA approved; synthetically color dyed to permit visual identification of treated soil.
- C. Diluent: Recommended by toxicant manufacturer.

2.02 MIXES

A. Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
- B. Verify final grading is complete.

3.02 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

- C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.
- D. Applicator shall mix all treatment from a sealed package on site with the project construction superintendent in his company during the course of the mixing.

3.03 APPLICATION

- A. Comply with requirements of U.S. EPA and applicable state and local codes.
- B. Spray apply toxicant in accordance with manufacturer's instructions.
- C. Apply toxicant at following locations:
 - 1. Under Slabs-on-Grade.
 - 2. At Both Sides of Foundation Surface.
 - 3. Silt within 10 feet of Building Perimeter.
- D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.
- E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.
- F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
- G. Re-treat disturbed treated soil with same toxicant as original treatment.
- H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.04 PROTECTION

A. Do not permit soil grading over treated work.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. Work described in this section includes construction of new asphalt paving for parking areas at locations shown on the plans. Construction work items include a bituminous concrete binder layer, prime coat, tack coat, and bituminous concrete wearing surface. Pavement marking for parking areas is also included in this section.

1.03 SUBMITTALS

A. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Unless otherwise noted, specifications referred to herein shall be the State of Alabama Department of Transportation Standard Specifications for Highway Construction, 2008 Edition.
- B. Soil Testing: Laboratory and field density tests and other soils tests specified herein shall be performed by an independent soils testing laboratory selected and paid by the Contractor.

1.05 SITE CONDITIONS

- A. Weather Limitations: Construct asphalt concrete binder and surface courses when atmospheric temperature is above 40 degrees F (4 degrees C) and rising, and when subgrade is dry. Spreading operations shall be stopped when the air temperature is below 45 degrees F (7 degrees C) and falling.
- B. Grade Control: Establish and maintain required lines and elevations.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fine and course aggregates for bituminous concrete binder and wearing surface layer course shall be as specified in Alabama D.O.T. Specifications, Section 424.

- B. Job Mix: Mix shall be as specified in Section 424 for a 424*-B Superpave Bituminous Concrete Binder Layer, 3/4" and 1-1/2" maximum size aggregate ESAL Range A.
- C. Prime Coat: Bituminous material for prime coat shall be as specified in Section 401.
- D. Tack Coat: Bituminous material for tack coat shall be as specified in Section 405.
- E. Job Mix: Mix shall be as specified in Section 424 for a 42-A Superpave Bituminous Concrete Wearing Surface Layer, 1/2" and 3/4" maximum size aggregate.
- F. Paint for pavement marking shall conform to the requirements of Federal Specification TT-P-115, Class B, color white for regular parking and blue for handicap parking and shall be non-reflective or reflective as indicated on the drawings. It shall be well-ground and shall show easy brushing qualities. Paint shall be delivered to the job in original, unbroken containers, with label and tags intact. The paint shall not be thinned in excess of printed directions of the manufacturer.

PART 3 EXECUTION

3.01 PRIME COAT

- A. Description: The work covers the furnishing and placing of a bituminous prime coat on a compacted crushed aggregate soil base course which is to be covered by a bituminous binder layer.
- B. Construction Methods: Requirements are specified in section 401 of the Alabama D.O.T. Standard Specifications for Highway Construction.

3.02 PLANT MIX BITUMINOUS CONCRETE BINDER LAYER

- A. Description: The work consists of constructing a layer, composed of an aggregate and bituminous material hot mixed in a central plant and hot laid on the compacted subgrade in accordance with these specifications and at locations shown on the drawings.
- B. Construction Methods: Details and requirements for construction are specified in Section 424, which refers also to Articles 410.03 through 410.07 of the Alabama D.O.T. Specifications.
- C. Compaction shall be as specified in Subarticle 410.03 (g) of the Alabama D.O.T. Specifications. At least three compaction tests will be required for each day of paving operations to determine that density requirements have been attained.

3.03 TACK COAT

A. Description: The work covers the furnishing and placing of a bituminous tack coat on a new bituminous concrete binder layer which is to be covered by a bituminous concrete

wearing surface or on an existing asphalt surface to receive a new bituminous concrete overlay.

B. Construction Methods: Requirements are specified in Section 405 of the Alabama D.O.T. Standard Specifications for Highway Construction

3.04 BITUMINOUS CONCRETE WEARING SURFACE

- A. Description: The work consists of constructing a hot bituminous concrete wearing surface on the previously constructed plant mix bituminous concrete binder layer in accordance with these specifications at locations shown on the drawings. See details.
- B. Construction Methods: Requirements shall be the same as specified in Section 424 which also refers to Article 410.03 through 410.07 of the Alabama D.O.T. Specifications.
- C. Compaction shall be as specified in Subarticle 410.03(g) of the Alabama D.O.T. Specifications. At least three compaction tests will be required for each day of paving operations to determine that density requirements have been attained.

3.05 EXISTING PAVEMENTS

- A. Broken Pavement: Repair existing pavement where damaged by construction activity. Carefully note and record condition of pavement prior to beginning work. Remove pavement for patching by cutting pavement in straight lines with power saw.
- B. Restore base course with crushed aggregate base course. Backfill in trenches is specified under other Sections; allow initial backfill to settle under traffic for 2 weeks before cutting out for new base course. Install new wearing surface as herein before specified.
- C. All patches shall be placed in straight lines, level with existing pavement, without bumps or sinks.

3.06 FIELD QUALITY CONTROL

- A. General: Test in-place asphalt concrete courses for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by Architect.
- B. Thickness: In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:
 - 1. Binder Course: 1/2", plus or minus.
 - 2. Surface Course: ¼", plus or minus.

- C. Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 10' straightedge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness.
 - 1. Binder Course Surface: 1/4"
 - 2. Wearing Course Surface: 3/16"
 - 3. Check surface areas at intervals as directed by Architect.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Walkways.
 - 2. Equipment Pads.
 - 3. Vehicular pavement.
- B. Related Sections include the following:
 - Division 2 Section "Earthwork" for subgrade preparation and grading. 1.
 - 2. Division 2 Section "Pavement Joint Sealants" for joint sealants within concrete pavement and at isolation joints of concrete pavement with adjacent construction.
 - 3. Division 3 Section "Cast-in-Place Concrete" for general building applications of concrete.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.04 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

- D. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
 - 1. Cementitious materials and aggregates.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Fiber reinforcement.
 - 4. Admixtures.
 - 5. Curing compounds.
 - 6. Applied finish materials.
 - 7. Bonding agent or adhesive.
 - 8. Joint fillers.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.
- E. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

1.06 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

2.01 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 - 1. Use flexible or curved forms for curves of a radius 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.02 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcement Bars: ASTM A615, Grade 60.

2.03 CONCRETE MATERIALS

- A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.
- B. Portland Cement: ASTM C 150, Type I or II.
 - 1. Fly Ash: ASTM C 618, Class F or C.
 - 2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Aggregate: ASTM C 33, uniformly graded, from a single source, with coarse aggregate as follows:
 - 1. Maximum Aggregate Size: 3/4 inch nominal.
 - 2. Do not use fine or coarse aggregates containing substances that cause spalling.
 - 3. Match existing aggregate to the extent possible.
- D. Water: ASTM C 94.

2.04 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.
- B. Air-Entraining Admixture: ASTM C 260.

A. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, ¹/₂ to 1-1/2 inches long.

2.06 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq.yd. dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlappolyethylene sheet.
- C. Water: Potable.
- D. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.07 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.08 CONCRETE MIXES

- A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
 - Do not use Owner's field quality-control testing agency as the independent testing agency.
- C. Proportion mixes to provide concrete with the following properties:

- 1. Compressive Strength (28 Days): 4000 psi for vehicular pavement, 3000 psi for all others.
- 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- 3. Maximum Water-Cementitious Materials Ratio: 0.50.
- 4. Slump Limit: 4 inches.
- D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Combined Fly Ash and Pozzolan: 25 percent.
 - 3. Ground Granulated Blast-Furnace Slag: 50 percent.
 - 4. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slage: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- E. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2.5 to 4.5 percent.
 - 1. Air Content: 6.0 percent for 3/4 inch maximum aggregate.
- F. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.

2.09 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94 and ASTM C 1116.
 - When air temperature is between 85 deg F and 90 deg F reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 PREPARATION

A. Proof-roll prepared subgrade surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

B. Remove loose material from compacted subgrade surface immediately before placing concrete.

3.02 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.03 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
 - 1. Apply epoxy repair coating to uncoated or damaged surfaces of epoxy-coated reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.04 JOINTS

- A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
 - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.
 - 1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into

concrete.

- 2. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
- 3. Use epoxy bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler less than ½ inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to the following radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 - a. Radius: 1/4 inch.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.
 - 1. Radius: ¼ inch.

3.05 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subgrade surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subgrade to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery, at Project site, or during placement.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete by mechanical vibrating equipment supplemented by handspading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- H. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
 - 1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.

- I. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations.
- J. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- K. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.06 CONCRETE FINISHING

- A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Medium-to-Fine- Textured Broom Finish: Draw a soft bristle broom across floatfinished concrete surface perpendicular to line of traffic to provide a uniform, fineline texture.
- C. Match existing finishing to extent possible.

3.07 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- C. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 - Moisture Curing: Keep surfaces continuously moist for not less than seven days 1. with the following materials:
 - Water. a
 - b. Continuous water-fog spray.
 - Absorptive cover, water saturated, and kept continuously wet. Cover concrete C. surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-2. retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - Curing Compound: Apply uniformly in continuous operation by power spray or 3. roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.08 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 - Elevation: 1/4 inch. 1.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch. 3.
 - 4. Joint Spacing: 3 inches.
 - Contraction Joint Depth: Plus 1/4 inch, no minus. 5.
 - Joint Width: Plus 1/8 inch, no minus. 6.

- A. Testing Agency: Owner will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: Testing shall be performed according to the following requirements:
 - 1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C 172, except modified for slump to comply with ASTM C 94.
 - 2. Slump: ASTM C 143; one test at point of placement for each compressivestrength test, but not less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
 - 3. Air Content: ASTM C 231, pressure method; one test for each compressivestrength test, but not less than one test for each day's pour of each type of airentrained concrete.
 - 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of compressive-strength specimens.
 - 5. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
 - 6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but not less than 25 cu. yd., plus one set for each additional 50 cu. yd. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.
 - 7. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 8. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive compressive-strength testing if adequate evidence of satisfactory strength is provided.
 - 9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.

- 10. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength by more than 500 psi.
- C. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as the sole basis for approval or rejection.
- E. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicated slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.10 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.
- B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - Expansion and contraction joints within portland cement concrete pavement. 1.
 - 2. Joints between portland cement concrete and asphalt pavement.
- B. Related Sections include the following:
 - 1. Division 2 Section "Cement Concrete Pavement" for constructing joints in concrete paving.
 - Division 7 Section "Joint Sealants" for sealing nontraffic and traffic joints in 2. locations not specified in this Section.

1.03 SUBMITTALS

A. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful inservice performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures,

contaminants, or other causes.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
 - 2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F (4.4 deg C).
 - 3. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than that allowed by joint sealant manufacturer for application indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.02 HOT-APPLIED JOINT SEALANTS

- A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Elastomeric Sealant for Concrete:
 - a. Roadsaver Silicone NS; Crafco, Inc.
 - b. Hi-spec; W.R. Meadows, Inc.

2.03 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rod for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

2.04 PRIMERS

A. Primers: Product recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint- sealant-substrate tests and field tests.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions applicable to products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants

relative to joint widths that allow optimum sealant movement capability.

- 1. Do not leave gaps between ends of backer materials.
- 2. Do not stretch, twist, puncture, or tear backer materials.
- 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Provide joint configuration to comply with joint sealant manufacturer's written instructions, unless otherwise indicated.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of water systems work is indicated on drawings and schedules, and by requirements of this section.
- B. Refer to Division-31 section "Earthwork" for excavation and backfill required for water systems; not work of this section.
- C. Refer to Division-22 section "Plumbing" for interior building systems including interior piping, fixtures, and equipment; not work of this section.

1.03 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacturing of water systems materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with water piping work similar to that required for project.

1.04 CODES AND STANDARDS:

- A. Plumbing Code Compliance: Comply with applicable portions of National Standard Plumbing Code pertaining to selection and installation of water system materials and products.
- B. Water Purveyor Compliance: Comply with requirements of the City of Troy Utilities Department. Obtain required permits and inspections.

1.05 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data and installation instructions for water system materials and products.
- B. Record Drawings: At project closeout, submit record drawings of installed water system piping and products, in accordance with requirements of Division 1.

1.06 PROJECT CONDITIONS:

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated.
- C. Notify Architect not less than two days in advance of proposed utility interruptions.
- D. Do not proceed with utility interruptions without Architect's written permission.

PART 2 - PRODUCTS

2.01 PIPES AND PIPE FITTINGS:

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections
- B. 2.1.2 Piping: Provide pipe of the following material, of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.
- C. Pipe and Fittings:
 - 1. PVC Plastic Pipe: ASTM D1785, with marking "NSF-pw" according to NSF 14.

2.02 NON-FREEZE GROUND HYDRANTS:

A. Box hydrant with Heavy Duty Cover "Jay R. Smit Fig. 5950, "3/4" inlet or an approved equal. Bronze hydrant with bronze casing, "T" handle key and cast iron box with Heavy Duty Cover with lifting device. 2 feet depth of bury. Provide with tapped drain holes.

2.03 CONCRETE:

A. All concrete including but not limited to thrust blocking, dead men, etc. shall have a 28 day compression strength of not less than 3000 pounds per square inch.

2.04 GRAVEL:

A. Gravel for drainage shall be washed 3/4 inch crushed rock or graded river gravel and shall be free of organic matter, sand, loam, clay and other particles that will tend to restrict water flow through the gravel.

3.01 INSTALLATION OF PIPE AND PIPE FITTINGS:

A. During installation of water lines the Contractor will be required to conduct his operations in a safety conscious manner. The Contractor shall comply with all applicable safety requirements in the location of the construction area. The Contractor alone shall be responsible for the safety, efficiency, and adequacy of his plant, appliances, and methods, and for any damage which may result from their failure or their improper construction, maintenance, or operation.

3.02 SUPERVISION OF WORK:

A. All work in progress shall receive the personal attention either of the Contractor or of a competent and reliable superintendent who shall have a full or final authority to act for him.

3.03 AUTHORITY AND DUTIES OF INSPECTOR:

A. The Governing Authority Inspector shall be authorized to inspect all work done and all material furnished, including preparation, fabrication and manufacture of the materials to be used. The Inspector shall not be authorized to alter or waive any requirements of the specifications without consent of the Architect. He shall call the attention of the Contractor to any failure of the work or materials to conform to the specifications. He may reject material or suspend the work until any questions at issue can be referred to and decided by the proper authority. The presence of the Inspector shall in no wise lessen the responsibility of the Contractor.

3.04 TRENCHES:

- A. Water mains shall have at least 30 inches and not more than 48 inches of cover over the top of the pipe. Trenches shall be widened and deepened at all points where joints occur to such extent as to facilitate the proper making, tightening, and inspection of joints. The bottom of the trench shall be so shaped that except at "bell holes" the pipe, where laid, shall have a substantially uniform bearing throughout its length.
- B. If an unstable trench bottom is encountered, the trench shall be undercut 4 to 6 inches and a suitable select granular material used to stabilize the trench bottom.
- C. The trenching and pipe laying shall be done in an orderly fashion and in a workman like manner. Excessive water shall be pumped from the trench before the pipe is laid. Back of curb, intersections, and locations where the gate valves will be set, shall be staked before the main is laid.
- D. Pipe shall be handled in such a manner as to protect the lining and the pipe from being damaged. It should NOT be dropped while unloading or while being installed in the

trench. The Inspector has the right to reject any damaged material.

- E. The pipe shall be kept clean of dirt, clods, and debris, etc., while being installed. It shall be properly plugged off at the end of the working day or when work is suspended to prevent the entrances of foreign materials (i.e., storm water, dirt, animal, etc.).
- F. Pipe shall be laid true to line and grade except that it may be deflected within the limits of the manufacturer's recommendations for making necessary changes in direction.
- G. Water mains when laid shall have a minimum vertical clearance of 12 inches from other mains, laterals, pipes or other obstructions.

3.05 CONCRETE THRUST BLOCK (DEAD MAN):

A. A dead man shall be used for rodding on valves and fittings, etc., when other regular means of retention will not work or will be impractical.

3.06 FIELD QUALITY CONTROL:

- A. Before being pressure tested, all lines shall be thoroughly flushed to remove all debris, etc., that may be in the new main.
- B. Lines shall be flushed to achieve a velocity of 2 feet per second.
- C. All valves not required to be closed for isolation of the new line to be tested shall be open during the testing.
- D. After backfilling, all pipes shall be subjected to a hydrostatic test pressure of not less than 150 pounds per square inch by a pressure gauge.
- E. All visible leaks, when pressure is applied, shall be repaired and any pipe valve or fittings which when under the pressure test are found defective shall be replaced.
- F. The section of pipe tested shall be held at 150 psi for a minimum of 2 hours.
- G. Leakage of water shall not be greater than 25 gallons per 24 hours per inch of diameter per mile of pipe.
- H. The contractor shall provide all water, labor and material necessary for conducting the pressure test.
- 1. Upon successful passing of the pressure test, the lines shall be chlorinated. In the absence of prevailing code follow AWWA C651. The contractor will be responsible for the cost of chlorination and water used during construction and testing.

END OF SECTION 02666

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes sanitary sewerage outside the building.

1.03 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Non-pressure-Piping Pressure Ratings: At least equal to system test pressure.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe, pipe fittings, and seals from dirt and damage.

1.05 PROJECT CONDITIONS

- A. Site Information: Verify existing utility locations.
- B. Locate existing structures and piping to be closed and abandoned.
- C. Comply with requirements of the City of Northport Board of Utilities; obtain required permits and inspections. Pipe materials specified shall comply with the above agency. Should there be no material requirements from that agency, the general contractor may use any of the materials specified herein.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 PIPES AND FITTINGS

- A. Ductile-Iron Sewer Pipe: ASTM A 746, for push-on joints.
 - Standard-Pattern, Ductile-Iron Fittings: AWWA C110, ductile or gray iron, for 1. push-on joints.
 - 2. Gaskets: AWWA C111, rubber.
 - 3. ABS Sewer Pipe and Fittings: ASTM D 2751, for solvent-cemented or gasketed joints.

- a. Wall Thickness for NPS 8 to NPS 12 (DN200 to DN300): SDR 42.
- b. Gaskets: ASTM F 477, elastomeric seals
- 4. PVC Sewer Pipe and Fittings: According to the following:
 - a. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35. for solvent-cemented or gasketed joints.
 - 1) Gaskets: ASTM F 477, elastomeric seals.

2.03 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
 - 1. Cement: ASTM C 150, type II.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 - 4. Water: Potable.
- B. Portland Cement Design Mix: 3000-psi minimum, with 0.45 maximum watercementitious materials ratio.

2.04 CLEANOUTS

- A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, excoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:
 - 1. Light Duty: In earth or grass foot-traffic areas.
 - 2. Medium Duty: In paved foot-traffic areas.
 - 3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.05 OIL/GRIT SEPARATOR

A. Precast concrete as detailed in the drawings.

PART 3 EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork".
3.02 IDENTIFICATION

- A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping.
 - 1. Use warning tape or detectable warning tape over ferrous piping.
 - 2. Use detectable warning tape over nonferrous piping.

3.03 PIPING APPLICATIONS

A. General: Include watertight joints.

3.04 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawings plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.
- C. Extend sanitary sewerage piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.

3.05 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. General: Join and install pipe fittings according to installations indicated.
- B. Ductile-Iron Sewer Pipe with Ductile-Iron Fittings: According to AWWA C600.
- C. ABS Pipe and Fittings: As follows:
 - 1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
 - 2. Install according to ASTM D 2321.
- D. PVC Sewer Pipe and Fittings: As follows:
 - 1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
 - 2. Install according to ASTM D 2321.

- E. System Piping Joints: Make joints using system manufacturer's couplings, unless otherwise indicated.
- F. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.
- G. Install with top surfaces of components, except piping, flush with finished surface.

3.06 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318 and ACI 350R.

3.07 CLEANOUT INSTALLATION

A. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

3.08 TAP CONNECTIONS

- A. Make connections to existing manhole so finished Work complies as nearly as practical with requirements specified for new Work.
- B. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.09 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
 - 1. Place plug in end of incomplete piping at end of day when work stops.
 - 2. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate reports for each test.

- 5. If authorities having jurisdiction do not have published procedures, perform tests as follows:
 - a. Sanitary Sewerage: Perform hydrostatic test.
 - Allowable leakage is maximum of 50 gal. Per inch of nominal pipe size per mile (4.6 L per millimeter of nominal pipe size per kilometer) of pipe, during 24-hour period.
 - 2) Close openings in system and fill with water.
 - 3) Purge air and refill with water.
 - 4) Disconnect water supply.
 - 5) Test and inspect joints for leaks.
 - 6) Option: Test ductile-iron piping according to AWWA C600, Section "Hydrostatic Testing." Use test pressure of at least 10 psig (69 kPa).
 - (a) Sanitary Sewerage: Perform air test according to UNI-B-6.
 - Manholes: Perform hydraulic test according to ASTM C 969 (ASTM C 969M).
 - 8) Leaks and loss in test pressure constitute defects that must be repaired.
 - 9) Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 02530

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